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MGM Journal of Medical Sciences

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From Editor's Desk

Healthcare-associated infections (HAIs), also called hospital-acquired infections and nosocomial infections, account for considerable morbidity and mortality all over the world. Reported prevalence rates range widely: Italy 5%, France and UK 6%, and USA 10%. Prevalence rate of HAIs in Indian hospitals has been reported to range from 18 to 35% in intensive care units (ICUs). In addition to loss of many precious lives due to HAIs, there is a huge increase in healthcare costs, because of prolonged hospital stay, costly additional lab investigations, and necessity of using expensive antibiotics and other life support measures to treat such patients. For example, in USA, about 1,00,000 patients die of HAIs every year with additional direct financial burden to the health services to the tune of 11 billion US dollars. Commonest type of HAIs is a urinary tract infection in patients with indwelling catheters. Others are respiratory infection (including ventilator-associated pneumonia), gastrointestinal infection, surgical site infection, blood stream infection (ranging from bacteremia to infected implants to septicemia), and puerperal fever.

Most important mode of transmission is by direct contact. Other modes are droplet infection, air-borne transmission, and vector-borne transmission (flies, mosquitoes, rodents, etc). Preventive strategies against HAIs are quite well known. Most modern hospitals have effective standard operative procedures (SOPs) and active infection control teams to control HAIs. If SOPs are implemented properly and strictly, HAIs can be prevented to a large extent. Complete elimination may not be possible because many of the ICU patients are immunocompromised due to a variety of reasons (advanced age, frailty, malnutrition, malignant diseases, chemotherapy, steroid use, diabetes, and human immunodeficiency virus infection, etc.).

It is imperative that all hospitals and other healthcare facilities ensure that all infection control protocols, procedures, directives, and practices are rigorously implemented under strict and constant supervision of the designated infection control authorities which are fully and comprehensively empowered by the hospital management. It is their responsibility to ensure that all hospital personnel (doctors, nurses, technicians, central sterile services department staff, housekeeping and cleaning personnel, waste-disposal staff, heating, ventilation and air-conditioning personnel, catering staff, laundry workers, store-keepers, etc) are sensitized, educated, trained, familiarized, and updated continuously about infection prevention practices. Equally important is the role of clinicians in senior positions to teach their juniors to observe infection control practices strictly and not to misuse antibiotics indiscriminately. Fortunately in India, importance of preventing HAIs is being understood and acted upon by increasing number of healthcare providers in more and more hospitals. The journal MGMJMS keeps publishing, from time to time, articles pertaining to HAIs. This issue has two such articles, one about infection of central venous lines and another about infected ventriculo-peritoneal shunt, besides usual mix of articles about various disciplines of health sciences.

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ORIGINAL ARTICLE

A Study of Reasons for Nonimmunization among Children attending the Services of a Rural Hospital in Raigad District, Maharashtra

[1]Sunila Sanjeev, [2]Prasad Waingankar, [3]Seema Anjenaya, [4]BS Lohare

ABSTRACT

Introduction: Immunization is a cost-effective public health intervention to decrease childhood morbidity and mortality. According to the 3rd National Family Health Survey (NFHS-3), 43.5% children aged 12 to 23 months were fully vaccinated. The 3rd District Level Household & Facility Survey (DLHS-3) showed 69% full-immunization coverage in Maharashtra with major regional variations. Rural Hospital, Panvel (Raigad), is in a peri-urban area providing health services to a mix of urban, rural, and migrant population. The study was conducted in this hospital with the aim to understand why people seeking health services for secondary prevention refrain from complying with routine immunization services.

Objectives: To assess the reasons for partial and nonimmunization of the children and the knowledge regarding routine immunization.

Materials and methods: All children who completed 1 year but below 5 years of age, attending the Rural Hospital, Panvel, during a period of 1 month from October 16 to November 15, 2014, were screened and those who were not fully immunized for the age were included in the study. Sociodemographic background, immunization status, reasons for partial and nonimmunization, and knowledge about routine immunization data were collected by personal interview using a prestructured, pretested questionnaire after obtaining informed consent.

Results: Out of 303 children, 57 (18.8%) were found to be either partially immunized (47; 15.5%) or nonimmunized (10; 3.3%). The lack of knowledge (36%), lack of priority for immunization (33%), and poor communication by the health worker (21%) were the major reasons. 42% of the mothers were aware about the severity of the vaccine preventable diseases. However, 80% did not have the correct knowledge regarding the immunization schedule.

Conclusion: The opportunities to vaccinate are still being missed and consolidated efforts to improve the active involvement of mother in the immunization activity are required.

Keywords: Child immunization, Maharashtra, Nonimmunization, Rural hospital.

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INTRODUCTION

Universal child immunization has been one of the most significant and cost-effective public health interventions to decrease childhood morbidity and mortality. On November 19, 1985, Universal Immunization Programme was introduced in India, aiming at 85% of coverage of all infants by 1990. Further, a National Demographic goal to achieve universal immunization of children against all vaccine preventable diseases (VPDs) was set up by the National Population Policy 2000.[1] Immunization is provided free of cost at all government health facilities and also as immunization outreach session, yet, the coverage is low. According to NFHS-3, only 43.5% of children, aged 12 to 23 months, were fully vaccinated; 57.5% in urban and 38.6% in rural areas.[2] The DLHS-3 survey showed 69% full immunization coverage in Maharashtra.[3] However, further analysis of the survey by Dr. Wankhede showed large regional variations within the state regarding child immunization coverage.[4]

A number of community[5,6] and hospital-based[7,8] studies have brought to light the poor immunization coverage among the under 5 years children in India. The reasons for the lack of coverage vary from logistics to those dependent on human behavior. One of the usual reasons for poor immunization coverage is difficulty in reaching the service provider. The rural hospital in Panvel (Raigad district, Maharashtra) is in a peri-urban area providing health services to a mixed population of urban, rural, and migrants. The hospital provides free immunization services. Against this background, it was proposed to select the partially immunized and nonimmunized children who are already utilizing the health services at this hospital for various reasons in orders to understand why the people who otherwise seek health services for secondary prevention refrain from complying with the routine immunization services.

OBJECTIVES

The objectives of study were to identify the reasons for partial and nonimmunization of the children and to assess the knowledge of mothers of partial and nonimmunized children regarding routine immunization schedule.

MATERIALS AND METHODS

All those children who have completed 1 year but below 5 years of age, reaching the Rural Hospital, Panvel, irrespective of the reason of visit to the hospital, during the period of 1 month from October 16 to November 15, 2014, were screened for their immunization status and the children who were either partially or nonimmunized were selected for the study.

This is an observational study. For all the children who had not received the full course of immunization (appropriate vaccine doses required to be taken at that age as per National Immunization Schedule), the data regarding the sociodemographic background, immunization status, and reasons for partial and nonimmunization were collected by a personal interview using a prestructured questionnaire after an informed written consent from the mother. The details about the missed dose of bacille calmette guerin (BCG), three doses of Diphtheria, Pertussis, Tetanus (DPT) and Booster, three doses of oral polio vaccine (OPV) and Booster, three doses of Hepatitis B and measles vaccine was noted. The scar of BCG was also checked.

The child was considered as immunized or not based on the information in the immunization card. For those without an immunization card, information from the mother or any other responsible and reliable person in the family stating that the child had been immunized was considered after thorough scrutiny. The child who had completed 1 year of age but not received any vaccine was recorded as nonimmunized, while if received and some of the vaccines were due, this was recorded as partially immunized.

The knowledge of the mothers about routine immunization schedule was assessed with open-ended questionnaire. Data were entered in a spreadsheet and analyzed using Microsoft Excel and EpiInfo.

RESULTS

A total of 303 children between the ages of 1 and 5 years, who visited the hospital for various reasons during the study period, were checked for their immunization status. Among these, 57 (18.8%) children were found to be either partially immunized or nonimmunized and were included in the study. There were 47 (15.5%) partially immunized children and 10 (3.3%) nonimmunized. The sociodemographic characteristics of these children are seen in Table 1.

Table 1: Sociodemographic profiling of study subjects

Variable no. (n = 57) Percent		
Age		
12–24 months	23	40.35
> 24 months	34	59.64
Sex		
Males	36	63.15
Females	21	36.84
Religion		
Hindus	42	73.68
Muslims	15	26.31
Birth order		
1	15	26.31
2	24	42.11
3	12	21.05
≥ 4	6	10.52
Type of family		
Nuclear	30	52.63
Joint	21	36.84
Three generation	6	10.52
Literacy of the mother		
Illiterate	37	64.91
Primary	3	5.26
Secondary	5	8.77
Higher secondary	8	14.04
Graduate	3	5.26
Postgraduate	1	1.75
Occupation of the mother		
Unemployed	36	63.15
Unskilled work	16	28.07
Semi-skilled work	5	8.77
Socio economic status (BG Prasad Classification 2013)		
Class II	16	28.07
Class III	26	45.61
Class IV	14	24.56
Class V	1	1.75

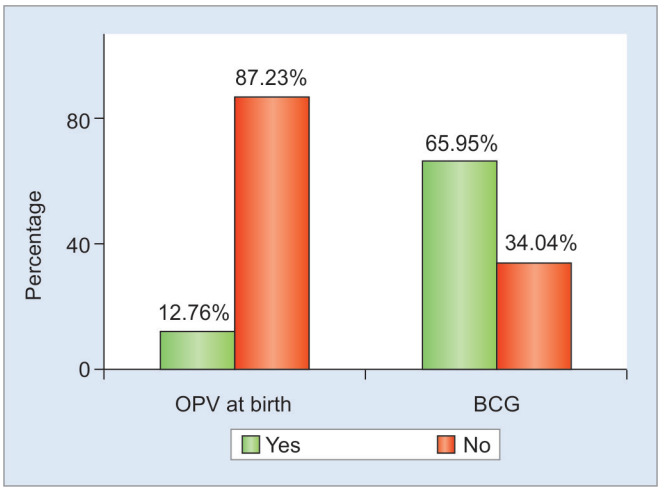
The mean age of the children under study was 27 months, with a minimum age of 12 months and a maximum of 58.3 months. In the present study, 36 (63.15%) children were males. Majority (24 children (42.10%)) of the children were of the second-order birth.

Thirty (52.63%) children were from nuclear families and 21 (36.84%) were from joint families, while the rest (6 (10.52%)) were from three-generation families. Majority (37 (64.91%)) of the mothers were illiterate. Most of the children (40 (70%)) were from socioeconomic class III or IV (BG Prasad classification 2013).

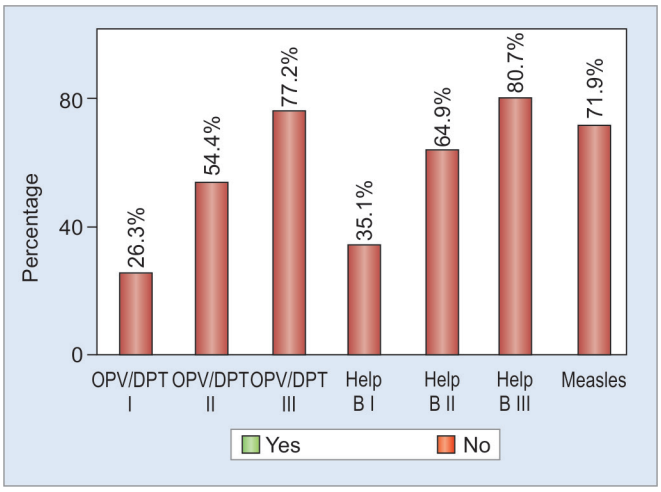
IMMUNIZATION PROFILE OF CHILDREN

Immunization card was present with 27 (47.36%) children, the card was at home in respect of 12 (21.05%), and 18 (31.57%) children did not receive any card.

As seen in Graph 1, among the 57 children in the study, 47 (82.45%) had institutional birth. It was observed that



Graph. 1: Vaccination in children with history of institutional birth



Graph 2: Vaccine and dose wise drop outs among partially and non-immunized children

among the 47 children, only 31 children (65.95%) received BCG vaccine at birth. Only six children (12.76%) received OPV zero dose.

Out of the 57 children in the study, 32 children (56.14%) were residing within 5 km of the hospital during the first year of life. Graph 2 shows that 41(73.7%) children received first dose of DPT, 26 children (45.62%) received the second dose of DPT/OPV, and 13 children (22.81%) received the third dose of DPT/OPV. Similarly, 37 children (64.92%) received the first dose of Hepatitis B vaccination, 20 children (35.08%) received the second dose, and 11 children (19.3%) received the third dose.

Regarding measles vaccination, only 16 children (28.07%) received the vaccine. Among the 41 children who were not immunized against measles, 6 (14.63%) gave a history of suffering from measles.

Among the 57 children, 41 children were eligible for the first booster dose of DPT/OPV. Out of them, only 8 (19.5%) received it.

Reasons for Partial Immunization or Nonimmunization

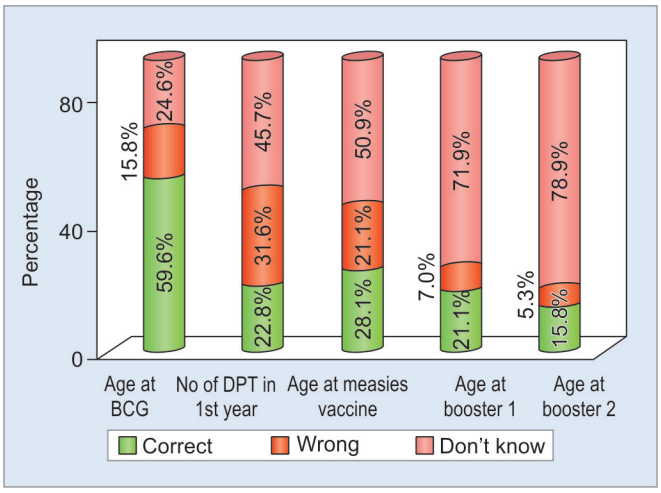
As Table 2 shows, various reasons were given by the mothers for missing the vaccination. It was observed that the major reason for missing the vaccination was the lack of knowledge about vaccination schedule in 21 mothers (36.84%), followed by the reason of being busy with work in 19 mothers (33.33%). The other significant reasons were not knowing the timing of subsequent vaccination and the place or center for vaccination after migrating for work.

Knowledge regarding Routine Immunization Schedule

As seen in Graph 3, knowledge of routine immunization among the mothers of the study group is poor. When

Table 2: Reasons for nonimmunization and partial immunization

	Reasons (includes multiple reasons) no. (n = 57) percent		
I	Lack of information		
	a) Unaware of vaccination schedule	21	36.84
	b) Not informed about subsequent vaccination	12	21.05
	c) Unaware of the days of vaccination	9	15.78
	d) Did not know the center for vaccination	12	21.05
II	Lack of priority		
	a) Busy with work	19	33.33
	b) Lost the card	2	3.50
	c) Forgot about vaccination	4	7.01
	d) Mothers sickness	2	3.50
III	Misinformation		
	a) Child was ill	8	14.03
IV	Dissatisfied		
	a) No faith in vaccination	1	1.70
	b) History of adverse event after vaccination	1	1.70
	c) Husband or Mother-in-law against vaccination	4	7.01
V	Problems in the provision of the services		
	a) Vaccination center is far	1	1.70
	b) Vaccine not available at the centre	0	0
	c) Vaccinator was not present	1	1.70
	d) Payment asked for vaccination	1	1.70



Graph 3: Mother's knowledge of routine immunization schedule

enquired whether vaccine-preventable diseases are severe, 24 mothers (42.10%) said yes, 23 (40.35%) said that they do not know whether they are severe, and 10 mothers (17.54%) said that they are not severe. More than half, that is, 34 mothers (59.64%) knew correctly the timing of BCG vaccine, 9 (15.78%) gave a wrong response, and 14 mothers (24.56%) did not know.

Regarding the number of the DPT/OPV doses given during the first year, 13 mothers (22.80%) knew correctly that it was three doses, 18 mothers (31.57%) gave a wrong response, and 26 mothers (45.67%) did not know. When asked about the age at which measles vaccine should be given to the child, 16 mothers (28.07%) gave a correct response of 9 months, 12 mothers (21.07%) gave a wrong response, and 29 mothers (50.87%) did not know.

About the knowledge regarding the age at first booster dose of DPT/OPV, majority, that is, 41 mothers (71.90%) did not know, 12 mothers (21.05%) knew correctly, and 4 mothers (7.01%) gave a wrong response. About the second booster dose of DPT, 45 mothers (78.94%) did not know when it should be given, 9 mothers (15.78%) knew correctly, and 3 mothers (5.26%) gave a wrong response.

DISCUSSION

Vaccination remains as one of the most cost-effective public health initiative. It is well known that percentage of protection may be reduced in partially immunized child. In the present study, 47 children (15.5%) were partially immunized and 10 children (3.3%) were nonimmunized. Hospital-based studies conducted by Kumar[7] and Agrawal[8] in medical college hospitals reported 44 to 48% partial immunization and 13.8 to 34.5% of nonimmunization respectively. Wadgave[9] reported 25.95% partially immunized and 9.76% of nonimmunized children in a study from urban health center OPD of Akola, Maharashtra. Community-based studies by Kar et al[6] and Angadi et al[10] reported that partially immunized were 15.1 to 62.58% and the nonimmunized were 15.1 to 2.58%. The percentage of the partially immunized and nonimmunized children depends on the design, population, and area of study.

The sociodemographic profile of the children in the present study shows that more than half (59.64%) were above 24 months of age; 63.15% were males. Majority of the children (42.10%) were second-order birth, followed by children of first-order birth (26.31%). Studies by Kumar et al,[7] Kar et al,[6] and Yadav et al[11] reported that female children and higher birth order were less likely to be fully immunized. As the present study was conducted in the hospital, it could have been that male children and lower-birth-order children were paid attention for their sickness and hence more male children are found to be partially immunized or nonimmunized.

Half of the children (52.63%) belonged to a nuclear family and 45.61% belonged to socioeconomic class III as per the BG Prasad classification 2013. Regarding the mothers of these children, 64.91% were illiterate and 63.15% were housewives. Dindod et al[12] reported that literacy of the mother is significantly associated with full immunization. Kar et al[6] and Angadi et al[10] reported that factors, such as mother's literacy, socioeconomic status, and the sex of the child were not significantly associated with immunization.

In the present study, among the 47 children (82.45%) who had institutional births, 31 children (65.95%) received BCG vaccine and only 6 children (12.76%) received OPV zero dose. Though BCG vaccine is given till 1 year of age, 34.05% children had missed the vaccination. Dindod et al[12] reported 87% institutional births and found that there was no association between place of delivery and immunization status. However, Kumar[7] reported that the children delivered in the hospital are more likely to be fully immunized. Sensitizing the mother during pregnancy and childbirth regarding the importance of immunization of the child needs to be addressed to ensure full immunization.

It was observed in this study that 42 children (73.69%) received the first dose of DPT/OPV, but only 13 children (22.81%) received the third dose. Only 16 children (28.07%) received measles vaccine. Out of the 41 children eligible for the first dose of DPT/OPV booster, 33 (80.48%) did not receive. High level of dropout rates is another concern. High levels of initial vaccination rates and low levels of OPV/DPT3 and measles were reported by Manjunath et al[13] from the study in a semi-urban area of Rajasthan. Similarly, a hospital-based study by Agarwal[8] also reported that the immunization status declined with age.

Among the various reasons stated by the mothers in the present study about missing the vaccination, it was found that lack of knowledge about routine immunization schedule (36.84%) and being busy with work (33.33%) were the major reasons. Kar et al[6] reported that child being ill (30.8%) and lack of knowledge about immunization schedule (23.1%) were the main reasons for missing. Devendra[7] reported that lack of knowledge about immunization (30.3%) and perception that vaccine has side effects (28.8%) were the major reasons. Though different studies bring many reasons for missing the vaccination, it is understood that the underlying reason is lack of awareness and motivation regarding immunization.

When the knowledge regarding routine immunization was assessed among the mothers of the children in the present study, it was observed that 34 mothers (59.64%) knew the timing of BCG vaccine. About one-fourth, that is, 13 mothers (22.80%) knew that DPT/OPV is given in

three doses within 1 year of age and 16 mothers (28.07%) knew that measles vaccine was given at 9 months of age. Twelve mothers (21.05%) were aware of the age at which the child should be given the first booster dose of DPT/OPV and 9 mothers (15.78%) knew correctly when the second booster dose of DPT/OPV should be given.

About 42.10% mothers knew that VPDs are severe, 23 mothers (40.35%) were not aware, and 10 mothers (17.54%) said that they are not severe. Though VPDs were perceived to be severe, still they did not completely immunize the child, which shows the importance of filling the gaps in the knowledge about correct age of vaccination and doses of routine immunization. Freeman et al[14] reported that provision of information to mothers regarding when to start the immunization and how often the child should be immunized were the key factors in determining immunization status. Anand et al[15] reported that as factors influencing demand vary greatly by region and context, findings from one population cannot always be extrapolated to another. Thus, simple operational research into knowledge and attitudes should become an essential part of every vaccination campaign.

CONCLUSION

The present study brings to light the poor knowledge regarding routine immunization schedule among the mothers. Lack of motivation among the mothers due to poor knowledge about the immunization schedule is the main cited reason for the partial or nonimmunization of the child. Hence, aggressive campaigning and dissemination of information is crucial for achieving universal immunization coverage.

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ORIGINAL ARTICLE

Cemented Total Hip Arthroplasty: A Study of 100 Cases

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ABSTRACT

Introduction: The cemented total hip athroplasty (THA) has been in existence for about three decades; however, objective outcome analysis of patients subjected to this procedure in India is lacking. At Joint Replacement Centre, Military Hospital (MH), Kirkee, Pune, Maharashtra, India, a large database of total hip arthroplasties exists. The cemented hip arthroplasties are being done regularly at MGM Medical College & Hospital, Kamothe. However, the functional results of cemented hips operated from 2003 to 2015 have been analyzed to assess the objective outcome.

Materials and methods: A prospective and retrospective study of 100 cemented hips in 92 patients between 26 and 78 years of age was carried out. Sixty-one (74%) patients were in the age group of 50 to 70 years. The diagnosis of these patients was avascular necrosis: 40; rheumatoid arthritis: 15; ankylosing spondylitis: 8; osteoarthritis: 12; fracture neck femur: 16; and fracture femoral head: 1. In all patients, cemented THA using Indian Orthopedics (INOR) indigenous and Zimmer implants were done. Three types of implants were used, Charnley 22 mm head, 26 mm head using INOR modular system and collarless polished tapered Zimmer system. Eight cases had bilateral involvement. The cases were followed up for varying periods from 1 to 10 years.

Results: The results were assessed by utilizing Charnley activity and pain score. There were 83% excellent, 8% good, 5% fair, and 4% poor results. Three cases required revision, two because of frank loosening, and one due to acetabular malpositioning. Charnley pain score improved from 2.2 preoperatively to 5.2 postoperatively (+28.3% change).

Conclusion: The cemented THA is an excellent salvage procedure for advanced hip disorders resulting in pain and disability, especially in late age groups beyond 50 years.

Keywords: Avascular necrosis, Deep vein thrombosis, Indigenous implants, Total hip arthroplasty, Zimmer implants.

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INTRODUCTION

The cemented total hip athroplasty (THA) has been in existence for about three decades; however, objective outcome analysis of patients subjected to this procedure is lacking.[1] In the current state of health care today, attention has to be directed to the cost of medical treatment with as much emphasis as the clinical outcome.[2] Most total hip replacement procedure has been evaluated by means of case studies.[3] Most cases come from different centers with virtually every known combination of patient, disease, surgeon, implant, and approach. Hence, there is no standardization and universally accepted outcome measures.

The joint replacement center, Military Hospital (MH), Kirkee, has been performing THA for the past more than 40 years. A large database of primary hip arthroplasty has been built up. This paper, however, will describe the results of 100 total hip arthroplasties done at MH, Kirkee, and MGM Medical College & Hospital, Navi Mumbai, where regular cemented hip arthroplasties is being done. The cases have been followed up for varying periods from 1 to 10 years.

MATERIALS AND METHODS

Ninety-two patients (100 hips) who underwent THA in the Joint Replacement Center of MH, Kirkee, and MGM Medical College & Hospital, Navi Mumbai, were included in this study. Bilateral THA was done in eight patients. Preoperatively, the Charnley class of activity, pain score, and functional scores for hip disability were recorded on each patient.[4,5] Data on pain, functional activity levels, range of hip motion, limb length discrepancy, and need for orthotic support were recorded. Standard posterior approach was adopted in all cases.[6] No trochanteric osteotomy was done. Cemented THA with first-generation cementation and Indian Orthopedics and Zimmer prosthesis were used. Surgical complications like operation site hematoma, deep/superficial infection, nerve palsy, dislocation, and medical complications like embolism, deep vein thrombosis (DVT), and gastrointestinal bleeding were recorded. Standard radiographic analysis of component position and cement bone interface were done

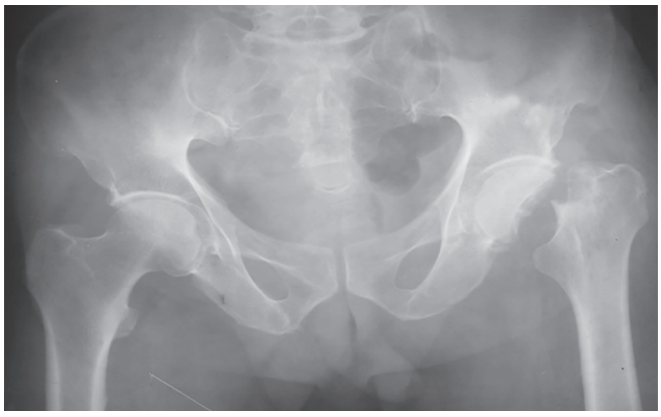

Fig. 1: Preoperative X-ray with nonunion neck femur fracture

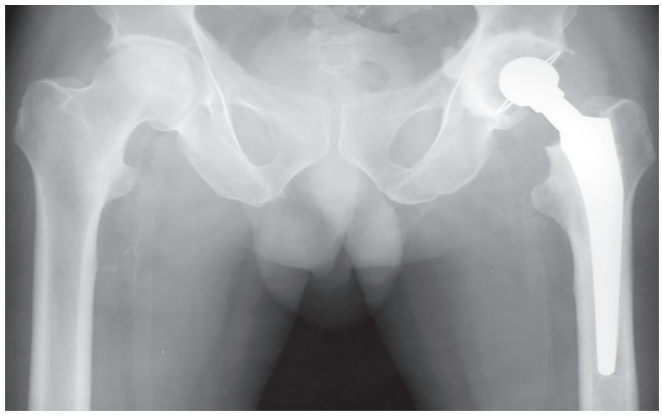

Fig. 2: Postoperative X-ray with cemented total hip replacement

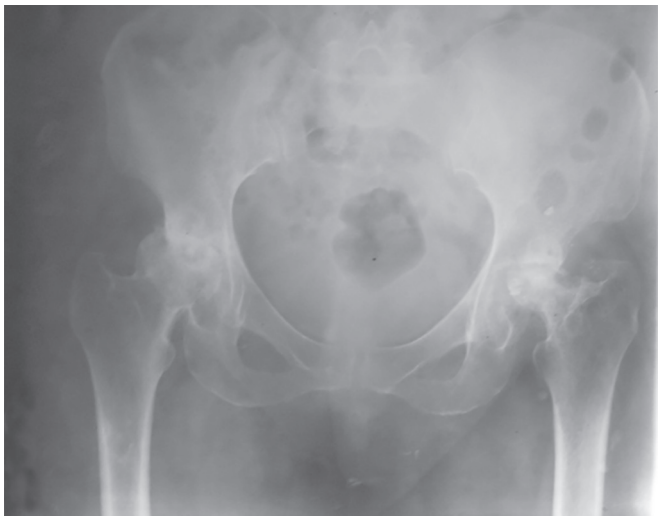

Fig. 3: Preoperative X-ray with a vascular necrosis femoral head

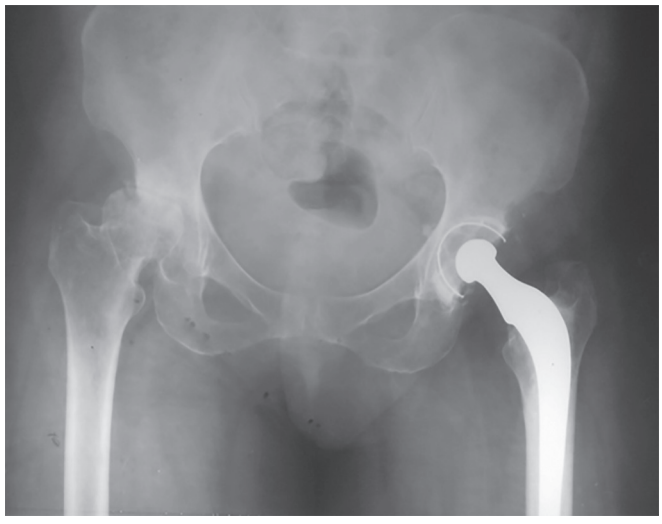

Fig. 4: Postoperative X-ray with cemented THR for avascular necrosis

at 6-month intervals.[7] Representative cases are shown from Figures 1 to 4.

All cases were followed for varying periods from 1 to 10 years. At the end of follow-up period, all postoperative results were graded into excellent, good, fair, and poor as per the following criteria:

Excellent	No limp, no pain, no need for external support.
Good	Mild activity-related pain, mild limp which disappears on using walking aid.
Fair	Moderate activity-related pain, limp, needs walking stick.
Poor	Pain at rest, severe lurch, walking impossible even with walking aid.

OBSERVATION AND RESULTS

One hundred primary cemented THAs were included in the study. The details regarding patient characteristics (age and sex) are summarized (Table 1). Indications for THA are given in Table 2. Seventeen cases had undergone previous hip surgery (other than THA/hemiarthroplasty),

Table 1: Sex and age distribution

		Number		
Sl. no.	*Age distribution*	*Male*	*Female*	*Total*
1	<30 years	2	0	2
2	31–40	4	2	6
3	41–50	4	6	10
4	51–60	18	10	28
5	61–70	26	7	33
6	71–80	12	1	13
	Total	66	26	92 (100%)

Table 2: Indications for THA

Sl. no.	*Pathology*	*No. of cases*
1	Avascular necrosis	48
2	Rheumatoid arthritis	15
3	Ankylosing spondylitis	8
4	Osteoarthritis	12
5	Fracture in femoral neck	16
6	Fracture in femoral head	1
	Total	100

Table 3: Types of previous surgery

Sl. no.	Types of surgery	No. of cases
1	Failed fracture fixation with dynamic hip screw	6
2	Fracture fixation with pins	4
3	McMurray's osteotomy	1
4	Synovectomy/debridement/biopsy	2
5	Core decompression with fibular bone grafting	4
	Total	17

such as fracture fixation and osteotomy. The details of previous surgery are shown in Table 3.

The majority of patients was in the age group of 50 to 70 years. The oldest patient was 78 years, a case of fracture neck femur. The youngest patient was a 26-year-old male, a case of posttraumatic avascular necrosis of right femoral head. The Charnley class of activity preoperative was recorded. About 60% had class A activity, 25% had class B activity, and 15% had class C activity. The mean preoperative pain score was 2.2 in the series of 100 hips. At 6 months postoperative follow-up, the mean pain score had improved to 5.5. The mean preoperative function score was 3.5, and this improved postoperatively at 6 months to 5.2. The results of the procedure are summarized in Table 4.

Of the cases followed radiographically for 1 to 10 years, 2 hips had gross endosteal femoral lysis and 1 case had early atrophy of calcar of the femur. There were 3 cases which were radiographically loose at maximum follow-up of 8 years. Of the 100 hips followed up, the postoperative functional results were excellent in 83, good in 8, fair in 5, and poor in 4. There were 2 wound infections, 3 dislocations, and 2 sciatic nerve palsies. Of the 2 wound infections, 1 was managed conservatively with dressing and antibiotics while in the other case implant removal had to be done. For the dislocations, 1 was reduced by open reduction while other 2 were reduced by closed method. Sciatic nerve palsies were managed conservatively and recovered in 10 to 12 weeks. There was no case of mechanical failure in any of the operated hips. Complications are summarized in Table 5.

Table 4: Primary total hip arthroplasty: Charnley scores

Category	Preoperative	Postoperative	Change
Pain score	2.2	5.5	+55%
Function score	3.5	5.2	+28.3%

Table 5: Complications

Sl. no.	Complications	No. of cases
1	Infection	2
2	Dislocation	3
3	Sciatic nerve palsy	2
4	Heterotopic ossification	1
	Total	8

DISCUSSION

The defining criteria for success with total hip arthroplasty includes predictable fixation to the skeleton, the performance of an implant in difficult patient populations, and long-term success without causing bone loss from the skeleton.[8] In this series of 100 hips, the THA was performed with standard indigenous Indian prosthesis, and Zimmer implants has offered superb improvements in quality of life and function. The outcome measure used in the present study was Charnley activity score. The mean preoperative pain score of 2.2 improved to 5.5. Preoperative function score of 3.5 improved to 5.2 in a span of 6 months in the present series. The excellent early results demonstrated in this series compares favorably with outcome using more costly foreign made prosthesis.[9,10]

Patient selection is an important criterion in establishing the cost-effectiveness and long-term benefit analysis of the procedure of THA. Too often it is seen that hip replacement is being "loosely" offered to an undeserving patient without exploring other orthopedic alternatives. Increasingly, total hip replacement is being offered to patients with fracture neck femur. It is recommended that despite the excellent results, THA is a "salvage" procedure and should be considered after all alternatives are exhausted. As such, it is not recommended for performing cemented THA on any patient less than 30 years of age. Cementless THA and surface arthroplasties are being done more frequently for younger patients. The absence of significant postoperative infections in this series can be partly attributed to the availability of dedicated joint replacement operation theater (OT) with laminar flow.

It has been found that standard prophylactic measures against DVT in the form of preoperative and postoperative injection clexane for 10 days and physiotherapy are very effective in all cases of THA to prevent DVT. No patient had clinical evidence of DVT. Thus, only clinical methods to assess DVT were used in this study, and more conclusive study using laboratory methods to diagnose DVT is needed before recommending the above protocol as a standard DVT prophylactic measure in total hip surgery.

CONCLUSION

The cemented THA procedures reproduced excellent results in most cases deserving hip replacement. The standard posterior approach is excellent for replacement surgery. Infections can be eliminated to a great extent by using dedicated OT and laminar air flow systems. Proper patient selection is essential to ensure longevity of prosthesis and maintenance of good postoperative results.

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ORIGINAL ARTICLE

Level of Physical Exercise Capacity, Respiratory Muscle Strength and Peak Expiratory Flow Rate in Healthy Adolescents

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ABSTRACT

Introduction: The maturation of respiratory system in children leads to changes in value of respiratory parameters like peak expiratory flow rate (PEFR), maximum inspiratory pressure (MIP), maximum expiratory pressure (MEP), and 6-minute walk distance (6MWD). Accurate analysis and clinical decision-making in disease state require reference values for different ages. The current study was undertaken to study pulmonary function and exercise capacity in children and adolescents.

Materials and methods: After obtaining Institutional Ethical approval and parental informed consent, 262 subjects aged 9 to 15 years were recruited for the study. They were divided into two age groups, i.e., preadolescent (9–12 years) and early adolescent (13–15 years). Demographic details including age, sex, height, weight, and body mass index (BMI) were noted. Physical activity rating (PAR) scale was used to denote physical activity levels. Peak expiratory flow rate was measured using standard Mini-bell peak flow meter (PFM). The parameters MIP and MEP was measured using micro respiratory pressure meter, and 6-minute walk test (6MWT) was performed as per American Thoracic Society (ATS) guidelines.

Results: A significant difference was noted between the two groups in PEFR, MIP, MEP, and 6MWD ($p = 0.00$). Age showed a strong positive correlation with PEFR ($r = 0.613$, $p = 0.000$), MIP ($r = 0.676$, $p = 0.000$), and MEP ($r = 0.658$, $p = 0.00$) whereas showed a strong negative correlation with 6MWD ($r = –0.605$, $p = 0.00$). Height showed a strong positive correlation with MEP ($r = 0.720$, $p = 0.000$) whereas a strong negative correlation with 6MWD ($r = –0.42$, $p = 0.00$). Weight showed a weak negative correlation with 6MWD ($r = –0.328$, $p = 0.00$). Gender difference was noticeable in 6MWD and PEFR ($p = 0.00$) but not in MIP ($p = 0.45$) and MEP ($p = 0.44$). Almost 22.10% of early adolescents were overweight compared to only 7.7% seen in preadolescent group.

Conclusion: PEFR and respiratory muscle strength was higher in early adolescents as compared to pre-adolescents. However, exercise capacity reflected by 6 MWD was found to be lower in early adolescents in comparison to pre-adolescents. These findings could be used while interpreting the outcome measures utilized while treating patients and for goal setting in cardiopulmonary rehabilitation in clinical practice.

Keywords: Maximum expiratory pressure, Maximum inspiratory pressure, Peak expiratory flow rate, 6-minute walk test.

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INTRODUCTION

Chronic respiratory diseases, cardiovascular diseases, cancer, and diabetes are some of the most prevalent non-communicable diseases in India. Out of which, 11.8% of total deaths is from chronic respiratory diseases.[1] Most of the Asian countries including India and China account for a huge burden in terms of absolute numbers of patients.[2] Respiratory infections have been found to be more prevalent among school going children.[3-6] They may be more vulnerable to the effects of air pollution than adults owing to incomplete lung maturation at birth. Lungs do not complete their growth until full adult stature is achieved in adolescence.[7] In developing countries, these childhood respiratory diseases have significant adverse effects on the child's daily physical activities, schooling, family life, and finances.[8]

In an era of evidence-based treatment, the methods are mainstay in the management of these debilitating conditions. The clinical evaluation prior to and during treatment helps in setting the clinical goal. Pulmonary function tests are an essential component for evaluating the lung functions. For undertaking these tests, a specialized laboratory is required. Moreover, these tests are time consuming and expensive. In order to overcome these impediments, clinical assessment tools like peak expiratory flow rate (PEFR), respiratory pressures, and 6-minute walk test (6MWT) are utilized to assess respiratory functions. The results obtained through these tools are simple, reliable, reproducible, and easily measurable.

Peak expiratory flow rate is a reliable bedside tool. It can be measured using a relatively inexpensive peak flow meter (PFM) and is of value in identifying and assessing the degree of air flow limitations.[9,10] A good correlation between PEFR and forced expiratory volume (FEV_1) has been observed. Peak expiratory flow rate is usually affected by variables, such as, age, height, weight, gender, race, and environmental conditions.[10] Racial variation in lung function parameters has been attributed to different size and shape of ribcage, respiratory muscle strength, and

possibly parenchymal lung development. Peak expiratory flow rate values ranging from 144 to 516 L/minutes have been reported by various researchers.[11-14]

Evaluation of respiratory pressure quantifies respiratory muscle strength. Maximum inspiratory pressure (MIP) is a measure of inspiratory muscle strength. Maximum expiratory pressure (MEP) measures the strength of abdominal and intercostal muscles.[15-20] Respiratory pressures have been studied in children with neuromuscular and pulmonary diseases, such as, asthma and cystic fibrosis, besides used in rehabilitation programs, weaning, and postoperative processes.[18] However, literature on healthy Indian children is very scarce.

Cardiopulmonary exercise testing forms an integral role in pulmonary rehabilitation. Six-minute walk test is a submaximal, self-paced, simple, objective, reliable, valid, sensitive, and a reproducible measurement of functional capacity. Its principal advantage is its operational simplicity, low cost, and its better correlation with activities of daily living.[21] It has been used in young children, for whom performing maximal cardiopulmonary exercise tests is problematic, requiring a high degree of coordination and motivation.[21-25]

Adolescence is a period of intense change and ongoing growth of the respiratory system. Till date, whatsoever research studies have been undertaken, they have focused only on adult and pediatric population. But so far no study has been undertaken on transitional stage which goes often unobserved. Efforts have been made to explore the influence of adolescence on respiratory parameters.

MATERIALS AND METHODS

After seeking ethical clearance from Institutional Ethics Committee, 262 healthy children and adolescents aged between 9 and 15 years were recruited from MGM Primary and Secondary School, Nerul, Navi Mumbai. Parental informed consent was sought. Children were screened using health history questionnaire. Children with active illness, such as, fever, cold, cough, acute exacerbation of respiratory conditions, cardiac illness, congenital or acquired neuromuscular diseases, cognitive issues, psychiatric problems, metabolic, hepatic, renal dysfunctions, and recent surgeries were excluded. The sample studied was selected during the school timings as per their availability. Subjects were divided into two age groups – group A: Preadolescents (9–12 years) and group B: Early adolescent (13–15 years). The outcome measures evaluated were anthropometric measurements (weight in kg and height in cm), BMI (weight/height^2), PEFR (L/minutes), MIP (cm H_2O), MEP (cm H_2O), and 6MWD (m). Sitting hours were calculated based on total time spent in school, including nonparticipation in any extracurricular activities. To denote physical activity levels, physical activity rating (PAR) scale was used. In all tests, 262 children and adolescents participated. Each subject was given a prior practice test to ensure familiarity and to enable them to perform each test as per guidelines.

Peak expiratory flow rate was recorded using Mini-bell PFM (manufactured by Forumed Health care Products, Horts, 3 Street Pals 17256 Girona, Spain). Subjects were instructed to breathe and blow into the mouthpiece as quickly and as hard as he/she can. The best of three readings was recorded.

The respiratory pressure was recorded using a noninvasive Micro RPM (respiratory pressure meter) (Manufacturer: CareFusion Respiratory, 22745 Savi Ranch Pkwy, Yorba Linda, CA, USA) (Fig. 1). To record MEP, the subjects were instructed to insert the mouthpiece into the mouth ensuring that the flange was positioned over the gums and inside the lips and that the "bite blocks" were between the teeth. They had to inhale to total lung capacity and then exhale with as much effort as possible through the controlled leak of the meter for at least 2 seconds. The reading displayed showed the maximum MEP over 1 second. To record MIP, the subjects were instructed to exhale to residual volume and then to inhale through the mouthpiece with as much effort as possible for at least 2 seconds. The reading displayed the maximum MIP that was sustained over 1 second.

Six-minute walking test was performed according to ATS guidelines. The subjects were asked to walk as far as possible for 6 minutes, but not to run or jog. They walked back and forth along a straight flat corridor of 30 m demarcated by cones. They were permitted to slow down, to stop, and rest as necessary. They were allowed to lean against the wall for resting and resume walking as soon as they were able to do so. Encouragement was given every minute using standard ATS phrases in an even tone. Subjects were asked to report symptoms like chest pain, intolerable dyspnea, dizziness, leg cramps which were additional test termination criteria.[21] Pulse

Fig. 1: Micro RPM (respiratory pressure meter)

and respiratory rate, blood pressure, and rate of perceived exertion using modified Borg scale were recorded before and after the test until they recovered to basal levels. Numbers of laps walked were recorded and 6MWD was calculated as follows: 6MWD = (Number of laps × 30) m.

RESULTS

Data was analyzed using Statistical Package for the Social Sciences (SPSS) 16 software. Normal distribution of data was analyzed using kurtosis–skewness test. The outcome variables were compared between the two groups. The statistical significance was assessed using Student's t-test. Pearson's test of correlation was used to analyze correlations between age, height, weight, and respiratory parameters. Details of demographic and clinical respiratory variables have been presented in Table 1.

Table 1: Demographic and clinical parameters of subjects aged 9 to 15

Variables (n = 262)	*Preadolescents (n = 167)*	*Early adolescents (n = 95)*	
	Mean ± SD		*p-value*
Height (cm)	139.9 ± 8	154.1 ± 9.2	0.000*
Weight (kg)	36.9 ± 7.8	48.3 ± 11.3	0.000*
BMI (kg/m^2)	18.7 ± 3.2	20.2 ± 3.5	0.001*
PEFR (L/cm)	191.4 ± 49.2	255.6 ± 44.6	0.000*
MIP (cm H_2O)	28.3 ± 13.1	53.8 ± 21.6	0.000*
MEP (cm H_2O)	41.9 ± 15.9	65.1 ± 17.5	0.000*
6MWD (m)	709.8 ± 61.4	606.9 ± 92.7	0.000*
Sitting (hours)	8.87 ± 1.2	9.2 ± 1.3	0.032*
PAR	2.2 ± 0.6	2.3 ± 0.6	0.428

*Level of significance p ≤ 0.05; PAR: Physical activity rating; BMI: Body mass index; PEFR: Peak expiratory flow rate; MIP: Maximum inspiratory pressure; MEP: Maximum expiratory pressure; 6MWD: 6-Minute walk distance

Early adolescent group demonstrated a higher MIP, MEP, and PEFR (p = 0.000) and lower 6MWD as compared to preadolescents (Table 1). Analysis of correlation coefficient with demographic features of age, height, and weight revealed that age had strong positive correlation with PEFR (r = 0.613, p = 0.000), MIP (r = 0.676, p = 0.000), and MEP (r = 0.658, p = 0.00), whereas it showed strong negative correlation with 6MWD (r = –0.605, p = 0.00) (Figs 2 to 5). Height showed a strong positive correlation with MEP (r = 0.720, p = 0.000) whereas strong negative correlation with 6MWD (r = –0.42, p = 0.00). Weight

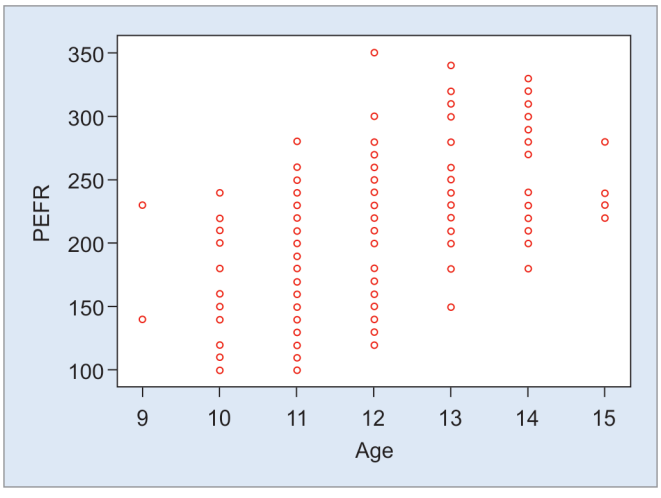

Fig. 2: Correlation between age and PEFR

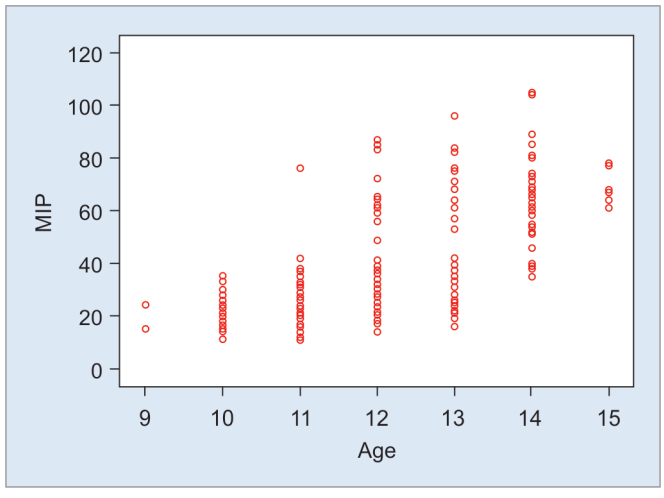

Fig. 3: Correlation between age and MIP

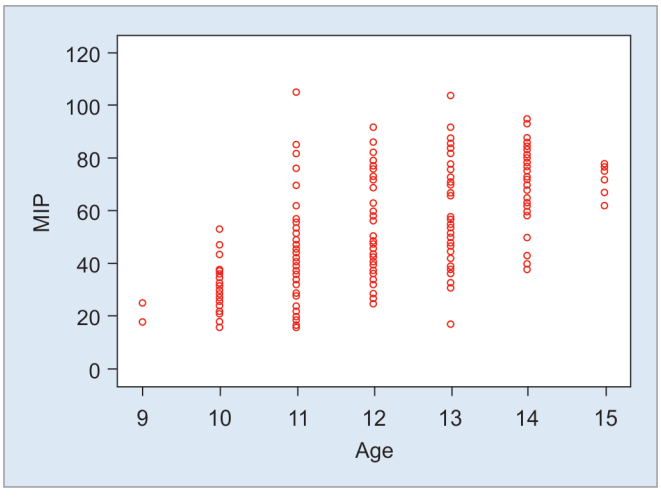

Fig. 4: Correlation between age and MEP

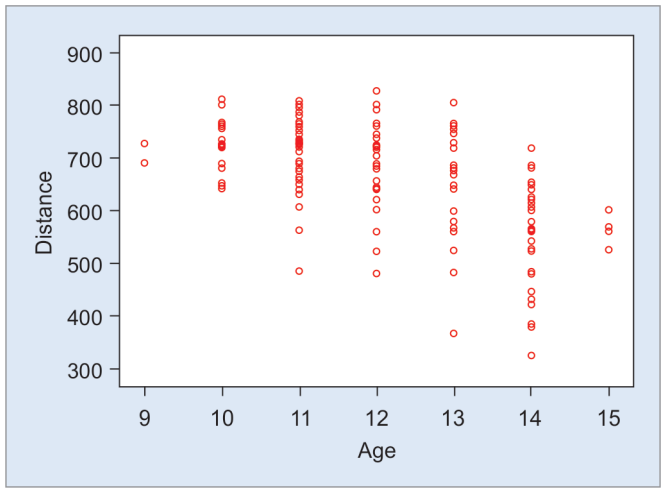

Fig. 5: Correlation between age and 6MWD

showed a weak negative correlation with 6MWD (r = –0.328, p = 0.00). According to Asian guidelines of BMI in children,[26] 22.10% subjects of early adolescent group were overweight compared to only 7.7% subjects of preadolescent group. Similarly, 1.05% subjects of early adolescent group were found to obese compared to 0.05% subjects of preadolescent group. Gender-wise comparison revealed that boys had higher PEFR (p = 0.008) and 6MWD (p = 0.000) as compared to girls in both groups. In addition, MIP (p = 0.459) and MEP (p = 0.440) were not significantly different between genders (Tables 2 and 3).

Table 2: Gender-wise comparison of parameters of subjects aged 9 to 15 years

Variables (n = 262)	*Boys (n = 137)*	*Girls (n = 125)*	
	Mean ± SD		*p-value*
Age (years)	12.01 ± 1.26	12.10 ± 1.50	0.606
Height (cm)	146.77 ± 11.74	143.22 ± 9.51	0.007*
Weight (kg)	42.86 ± 11.96	38.96 ± 8.75	0.003*
BMI (kg/m^2)	19.57 ± 3.49	18.90 ± 3.18	0.104
PEFR (L/cm)	223.50 ± 59.91	204.96 ± 51.44	0.008*
MIP (cm H_2O)	36.61 ± 18.96	38.53 ± 22.50	0.459
MEP (cm H_2O)	51.20 ± 19.70	49.30 ± 20.15	0.440
6MWD (m)	693.66 ± 65.15	649.52 ± 105.01	0.000*
Sitting (hours)	9.12 ± 1.31	8.84 ± 1.21	0.07
PAR	2.34 ± 0.61	2.14 ± 0.61	0.01*

*Level of significance p ≤ 0.05

Table 3: Gender- and age-wise comparison of parameters of subjects aged 9 to 15 years

	Boys		
	Preadolescent (n = 90)	*Early adolescent (n = 47)*	
	Mean ± SD	*Mean ± SD*	*p-value*
Sitting (hours)	8.98 ± 1.29	9.38 ± 1.31	0.088*
PAR	2.38 ± 0.63	2.26 ± 0.57	0.252
Height (cm)	141.22 ± 8.11	157.38 ± 10.23	0.000*
Weight (kg)	38.22 ± 8.42	51.74 ± 12.76	0.000*
BMI (kg/m^2)	18.97 ± 3.36	20.73 ± 3.47	0.005*
PEFR (L/cm)	200 ± 52.96	268.51 ± 45.11	0.000*
MIP (mm Hg)	28.91 ± 12.41	51.36 ± 20.66	0.000*
MEP (mm Hg)	43.12 ± 15.89	66.68 ± 16.90	0.000*
6MWD (m)	716.62 ± 53.55	648.74 ± 62.81	0.000*
	Girls		
	Preadolescent (n = 77)	*Early adolescent (n = 48)*	
	Mean ± SD	*Mean ± SD*	*p-value*
Sitting (hours)	8.71 ± 1.16	9.04 ± 1.29	0.154
PAR	2.04 ± 0.55	2.31 ± 0.66	0.010*
Height (cm)	138.43 ± 7.73	150.90 ± 6.65	0.000*
Weight (kg)	35.26 ± 6.62	44.90 ± 8.54	0.000*
BMI (kg/m^2)	18.44 ± 2.91	19.64 ± 3.49	0.051*
PEFR (L/cm)	181.30 ± 42.56	242.92 ± 40.79	0.000*
MIP (mm Hg)	27.49 ± 13.94	56.23 ± 22.41	0.000*
MEP (mm Hg)	40.36 ± 15.85	63.62 ± 18.02	0.000*
6MWD (m)	701.80 ± 68.99	566.75 ± 99.25	0.000*

*Level of significance p ≤ 0.05

DISCUSSION

Adolescence is characterized by a surge of growth hormones that leads to rise of all physiological functions. It is a transitional stage of physical and psychological human development that generally occurs during the period from puberty to adulthood. Average onset of puberty varies from 11 to 13 years in Indian children owing to variations in socioeconomic and nutritional status.[27-30] Some of the most significant components of pubertal development involves distinctive physiological changes in individual's height, weight, body composition, circulatory, and respiratory systems. Hormonal influence triggers the behavioral and physical changes. During adolescent growth spurt, there is a rapid increase in the individual's height and weight resulting from the simultaneous release of growth hormones, thyroid hormones, and androgen. It has been studied that these effects were reflected in the results of commonly utilized pulmonary function tests.[31]

Increased growth rate and pulmonary physiological development[32,33] led to a 33% rise in PEFR in early adolescents compared to preadolescents. A strong positive correlation was observed with age (r = 0.613, p = 0.00). Peak expiratory flow rate was found to be higher in boys (223.50 ± 59.91 L/cm) as compared to girls (204.96 ± 51.44 L/cm), which was found to be statistically significant (p = 0.008). This may be attributed to larger lungs per unit of stature of boys than girls. Even though number of alveoli per unit volume and area is identical, alveoli is more in boys than girls resulting in higher lung function. Additionally, girls have been reported to have less strength due to greater amount of fat and less muscle mass, thus leading to lower PEFR. This effect may be exaggerated by increased levels of reproductive hormones on airway diameter at puberty.[34,35]

Early adolescents demonstrated 90.1% higher values of MIP and 55.4% higher values of MEP in comparison to preadolescents (Table 1). Age correlated strongly with MIP (r = 0.676) and MEP (r = 0.658) (p = 0.00). Marly et al[18] attributed this effect to greater muscle area in older individuals. Supporting airway cartilage and small airway muscles is not developed until school age. The effect of compliant bony cartilage and ribs and the fact that younger children primarily use diaphragm and underdeveloped intercostals could contribute to lower respiratory pressures in preadolescents. The overall mean value for MIP and MEP was found to be 37.53 ± 20.71 cm H_2O and 50.29 ± 19.90 cm H_2O respectively. Compared to values reported previously, the current study recorded lower mean values for respiratory pressures. Geographical variations, different nutritional status, poor motivation in our subjects, and deliberate

leak in the mouthpiece of apparatus may have led to lower mean values. Studies have found MIP and MEP values higher in males than females.[19,20] However, in our study the difference was statistically insignificant.

Six-minute walk distance was found to be reduced in early adolescents compared to preadolescents ($p = 0.000$). It showed a strong negative correlation with age ($r = -0.604$) and height ($r = -0.42$), whereas a weak negative correlation with weight ($r = -0.328$). It is known that age, height, weight, and gender independently affects the 6MWD in healthy adults.[21] Increased weight must have escalated the workload for a given amount of exercise, probably resulting in shorter walking distance.[36] Almost 22.10% of the early adolescents were overweight compared to only 7.7% in the preadolescent group. This could be the probable reason for a lesser 6MWD as noted in them. Another reason for reduced endurance levels in early adolescents could be due to adoption of a sedentary lifestyle owing to higher academic stress and different leisure pursuits. This could be supported by increased sitting hours noted in the early adolescent group ($p = 0.032$). Factors, such as, motivation, attitude toward physical activity, and musculoskeletal pain might affect 6MWD.[21] These factors were beyond the scope of the study. The clinical tools were not included to measure specific motivation levels. Ulrich et al[37] have found the similar findings wherein 6MWD has been found to have increased until puberty and then has flattened. However, pubertal changes were not studied in depth and stands as a limitation. Distance covered by boys was significantly greater than girls ($6MWD_{boys} = 693.6\ m \pm 65.1$, $6MWD_{girls} = 649.52\ m \pm 105.01$, $p = 0.00$) by 6.8%. The influence of gender on the distance walked might be attributed to the greater absolute muscle strength, muscle mass, and increased height of boys in comparison to girls. During adolescence, though there has been an increase in strength in both the genders, the percentage of body fat in boys remains the same, whereas the percentage of body fat in girls increases significantly contributing to lesser walk distance in girls.[23-25]

The age at which the pubertal growth spurt occurs and the speeds with which adolescents experience puberty vary greatly and may affect physical activity.[9,32-34] Growth of the respiratory system is an ongoing process and is said to be completed by the age of 10 to 11 years. A significant effect of adolescence on respiratory parameters has been observed. Early adolescents have demonstrated higher values of PEFR, MIP, and MEP than preadolescents, suggesting a scope for intervention to enhance respiratory functions at this age. However, 6MWD has been found to be reduced with age, most likely due to increased percentage of overweight in higher age group. This could be a likely indication for the inclusion of weight reduction program as a part of clinical management and goal setting for cardiopulmonary rehabilitation in clinical practice.

The findings of this study should be viewed in light of its limitations. The present study reveals that findings are based on a convenience sample recruited from a single school. It limits the generalization of its results. Absenteeism and unavailability of higher class students post school hours owing to busy study schedule could have led to unequal distribution of samples in both groups. Motivation levels could have influenced the results of a few tests. Assessing attitudes, behavior, and motivation scores have been beyond the scope of this study.

CONCLUSION

Exercise capacity measured by 6 Minute Walk Test was lower in early adolescents compared to pre-adolescents suggesting need for increased participation of early adolescents in physical activity. Respiratory muscle strength and PEFR was higher in early adolescents as compared to pre-adolescents indicating ongoing maturation of respiratory system.

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ORIGINAL ARTICLE

Leprosy Scenario at a Tertiary-level Hospital in Navi Mumbai: A Four-year Retrospective Study

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ABSTRACT

Introduction: India was among the last few countries in the world to achieve leprosy elimination in 2005. However, wide variations in prevalence rates continue to exist across the states and regions in the country.

Aims: The purpose of the study is to determine the current clinical profile of leprosy from a tertiary-level hospital in Navi Mumbai.

Materials and methods: A retrospective study was done to determine the epidemiological and clinical profile of leprosy patients in a tertiary care center, MGM Medical College & Hospital, Navi Mumbai (September 2011 to August 2015). Data regarding demographic details, clinical features, investigations, treatment, and complications were analyzed.

Results: In total, 207 patients were registered over a 4-year period, with male:female ratio of 2.4:1 and children (≤ 14 years) constituting 7.2%. As per Ridley Jopling classification, borderline tuberculoid leprosy was the most frequent morphologic type, seen in 45.8%, followed by borderline lepromatous (28%), lepromatous leprosy (10.1%), and other forms in 11.5%. Multibacillary leprosy was the most common clinical type (81.1%). About 32.8% patients presented in reaction (type I in 22.7% and type II in 10.1%). World Health Organization (WHO) grade 2 deformities were diagnosed in 32.8%, with claw hand being the most common paralytic deformity (18.8%).

Conclusion: The study shows that despite statistical elimination, multibacillary disease, leprosy reactions, and deformities are commonly seen as presenting manifestations. Large population of migrant workers in Navi Mumbai could be a possible contributing factor towards these findings. It highlights the need to sustain and provide high-quality leprosy services to all patients through general health services, including good referral system. Investigations, such as slit skin smear and biopsy must be carried out for all newly diagnosed patients.

Keywords: Borderline tuberculoid leprosy, Grade 2 deformity, Leprosy epidemiology, Leprosy reactions, Multibacillary disease.

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INTRODUCTION

Leprosy has been a major public health problem in many developing countries for centuries. A major global share is from India. About 59% of the new leprosy cases detected globally in 2014–2015 were from India.[1]

As on April 1, 2015, 0.88 lakh cases were on record, giving a prevalence rate (PR) of 0.69 leprosy cases per 10,000 population as compared to a PR of 0.74 per 10,000 on April 1, 2008.[2] During 2014–2015, 1.25 lakh new cases were detected, which makes the annual new case detection rate (ANCDR) of 9.73 per 100,000 population. This shows an ANCDR reduction of 16.84% from 11.70 during 2007–08. To understand public health requirements in the country and to enable efficient national program planning and management, it is important to understand epidemiological profile. Through this study, efforts have been made to highlight the current clinical profile and epidemiology of leprosy by evaluating patients visiting our tertiary-care center in Navi Mumbai.

MATERIALS AND METHODS

A retrospective data analysis of all leprosy cases registered at Department of Dermatology of MGM Medical College & Hospital, Navi Mumbai, from September 2011 to August 2015, was carried out. Ethical clearance was obtained from institutional ethical clearance committee. Our hospital is situated near Panvel, which is the southernmost part of Navi Mumbai, with patients coming from Raigad district as well as from the adjacent Thane district. Case detection was based on voluntary reporting, referrals from local general practitioners, and the surveys conducted in schools and general population by leprosy workers associated with our institute. The data were analyzed according to age, sex, residence, type of leprosy, leprosy reactions, and deformities. Patients were classified as per Ridley Jopling classification[3] and as per the criteria laid down under the national leprosy eradication program (NLEP) and treated accordingly. In addition, as per the WHO classification,[4] the disease was

classified as multibacillary (MB) leprosy if there are six or more lesions, more than one nerve involvement and/or smear positive cases and as paucibacillary (PB) in other cases. At the end, data were compared with the national and global averages (Table 1).

RESULTS

A total of 207 new cases of leprosy were registered during the study period of 4 years (Table 2). The mean age of patients was 34.3 ± 15.9 years. Majority of the patients were in the young age group of 15 to 30 years (42%) (Fig. 1). Fifteen (7.2%) patients were children, and males outnumbered females with a ratio of 2.4:1.

Clinical Disease Spectrum Data Analysis

Multibacillary leprosy was the most common clinical type seen in 168/207 patients (81.1%). In total, 157 patients (75.7%) were in the borderline spectrum, that is, borderline tuberculoid (BT), mid-borderline (BB), and borderline lepromatous (BL). Borderline tuberculoid was the most frequent morphologic type, seen in 95 patients (45.8%) followed by BL in 58 (28%) and lepromatous leprosy (LL) in 21 (10.1%) patients. Additionally, other forms of leprosy were recorded in 24 (11.5%) patients including histoid, pure neuritic, and indeterminate forms in 4 (1.9%), 10 (4.8%), and 10 (4.8%) patients respectively (Fig. 2).

Clinically thickened peripheral nerve enlargement was recorded in 162/207 (78.2%) patients. Ulnar nerve was the most commonly thickened nerve seen in 60.8%, followed by common peroneal nerves in 40.5%, posterior tibial nerves in 31.8%, and radial cutaneous nerves in 30.4% patients. Only 29/95 BT patients (30.5%) had less than or equal to one nerve involvement. Biopsy records were available for 107/207 (51.6%) cases. Borderline tuberculoid leprosy was the most common histological diagnosis. Clinicohistopathological correlation was observed in 80 out of 107 cases (74.7%) with 27 cases (25.2%), demonstrating nonspecific histological features.

Table 1: Comparison of NLEP indicators in the present study with national and global trends (2014–2015)

Indicators (% of new cases detected)	*Present study*	*NLEP (India) 2014–2015*	*WHO (Global) 2014–2015*
Of childhood leprosy	07.24	09.04	08.8
Females	28.90	36.81	37.7
MB	81.15	52.82	60.6
Grade 2 disability	32.85	04.61	6.6

Table 2: Yearwise distribution of newly registered leprosy patients

	Total patients registered	*MB cases*		*Type 1 reaction*		*Type 2 reaction*	
Year	*n*	*n*	*%*	*n*	*%*	*n*	*%*
2011–2012	62	48	77.4	19	30.6	9	14.5
2012–2013	53	44	83.0	12	22.6	5	09.4
2013–2014	48	41	85.4	8	16.6	3	06.2
2014–2015	44	35	79.5	8	18.1	4	09.0
Total	207	168	81.1	47	22.7	21	10.1

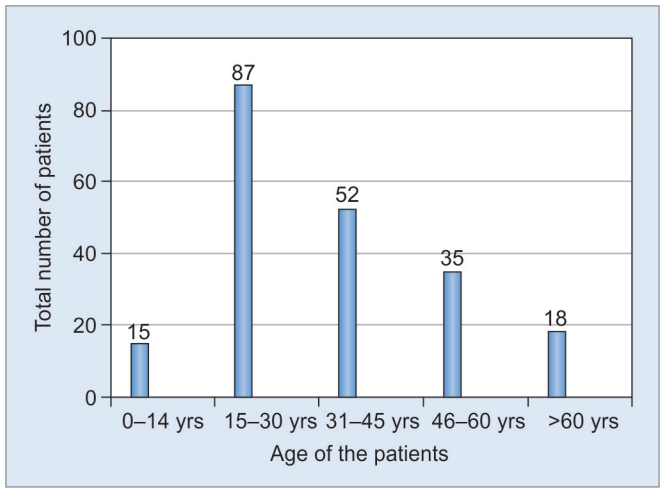

Fig. 1: Agewise distribution of newly registered leprosy patients

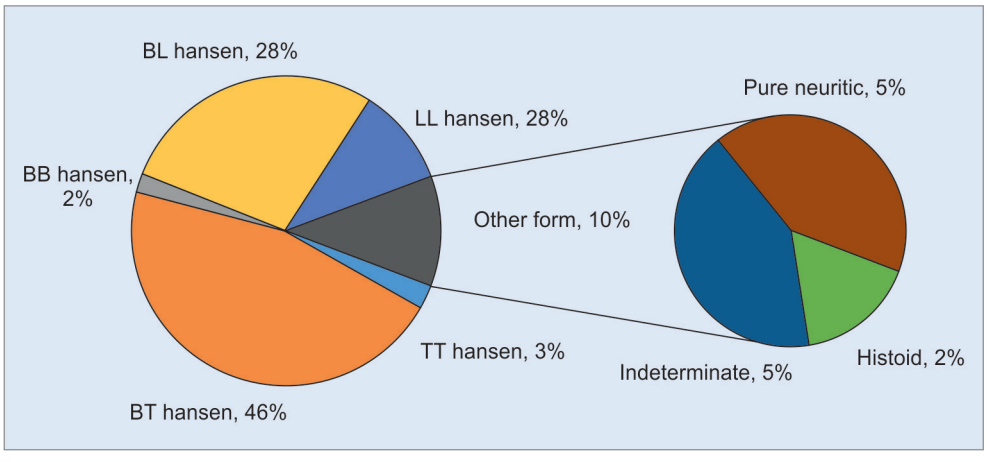

Fig. 2: Clinical presentation of newly registered leprosy patients

Reactions and Deformities

At first visit, 32.8% of the patients were seen to be in reaction. Type 1 lepra reaction (T1R) was present in 47 patients (22.7%) and type 2 lepra reaction (T2R) in 21 (10.1%) (Table 2). Among T1R, 51% of the cases were observed among BT patients, while most of the T2R (80.9%) was seen in lepromatous patients (BL and LL). Neuritis was seen in 33 patients (15.9%), of whom 12 had T1R and 4 had T2R. Ulnar nerve was the most commonly affected nerve (n = 19/33). Deformities (WHO grade II) of the hands, feet, or eyes was seen in 68/207 patients (32.8%) at the time of diagnosis. Among these, claw hand was the most common paralytic deformity seen in 39 (18.8%), followed by trophic ulcer in 35 (16.9%) and foot drop in 5 (2.4%) patients (Figs 3 to 6).

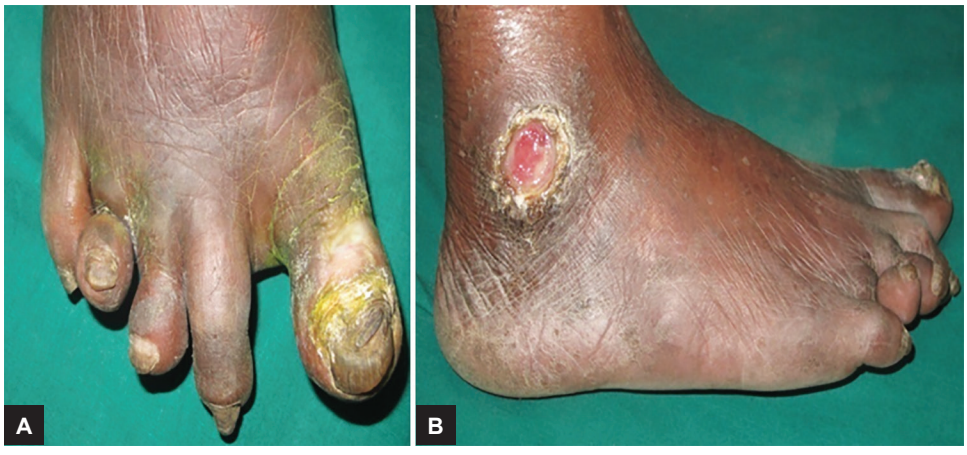

Fig. 3: A 55-year-old male patient of BL hansen with pseudoainhum and trophic ulcer

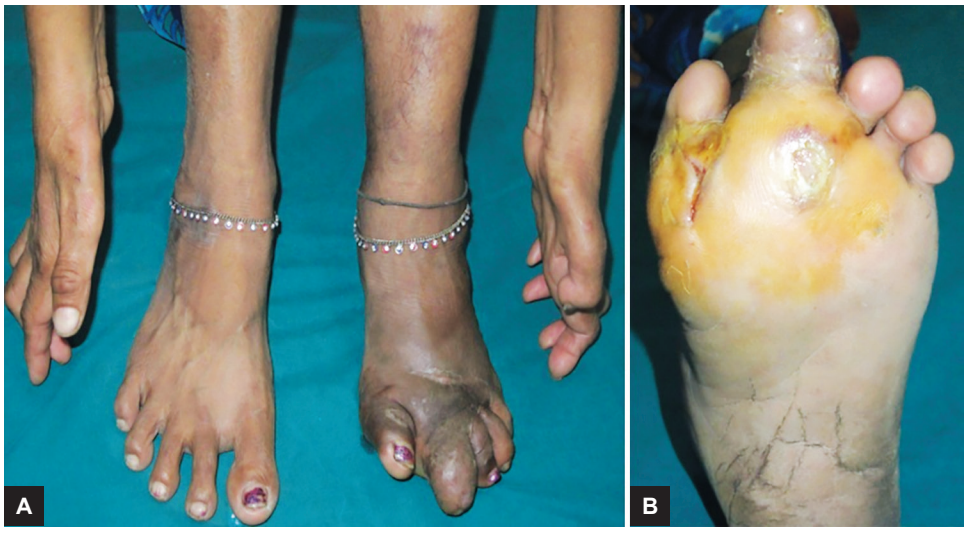

Fig. 4: A 45-year-old female with claw hands and left foot deformity

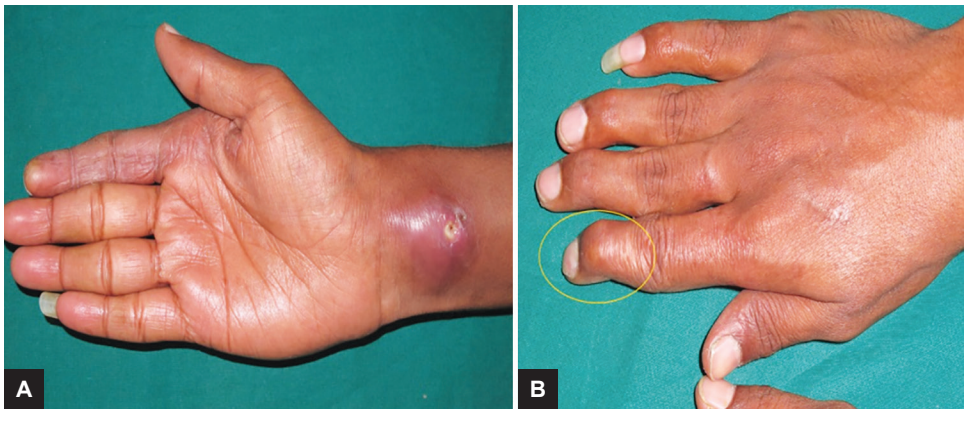

Fig. 5: A 35-year-old male having right median nerve abscess and claw

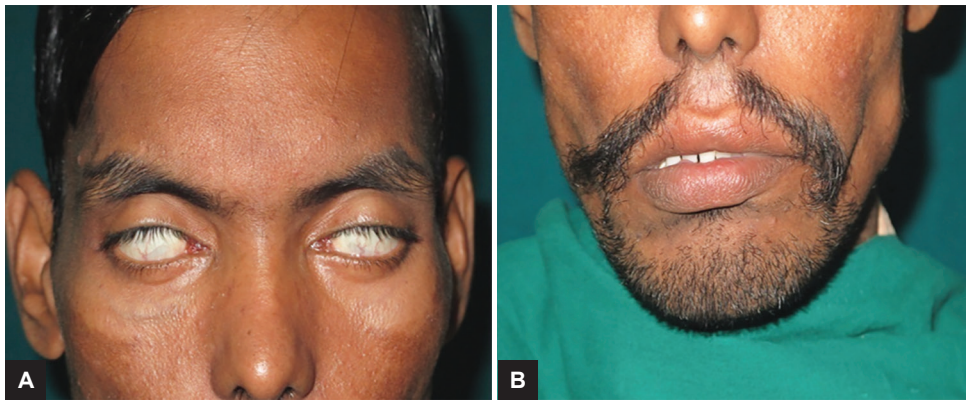

Fig. 6: A 30-year-old male BL hansen with lagophthalmos and deviation

DISCUSSION

As standardized by the WHO, multidrug therapy (MDT) is very effective and a powerful tool in treatment of leprosy, especially when patients report early and start prompt therapy. However, poor adherence has detrimental consequences, including incomplete cure, persisting infectious sources, transmission to new susceptible person, and multidrug resistance, and also risk of developing disability or deformity.[5] Early detection depends almost completely on voluntary reporting, which implies awareness of the disease and its treatment facilities. Our data from a tertiary care referral center show that an early active search for cases is required.

Multidrug therapy has brought down the prevalence of disease in India from 25.9 in 1991 to 0.69 per 10,000 populations in March 2015. However, as seen in the present data, the scenario is far from satisfactory. The number of new cases detected as reported by 121 countries globally during 2015 was 213,899, among which, India contributed 59% (125,785 cases).[1] Leprosy cases are not uniformly distributed in a country, but tend to cluster in certain areas, villages, or talukas. Prevalence rate of Maharashtra state is 0.95 per 10,000 populations, which is higher than the national PR of 0.69.[2] Mumbai represents 1.51% of the population of India, as per the 2011 census,[6] with a sex ratio of 853 females per 1000 males. Mumbai achieved elimination of leprosy in 2008–2009. However, rapid industrialization and increasing density of migrant population in slums is creating many challenges for health services management. Since the disease was declared eliminated, resources were taken from the control of leprosy and given to other areas, such as HIV and tuberculosis. The problem is, there are pockets in India where leprosy is still rife, and therefore we see a probable resurgence of the disease in recent years.[7]

In this study, the total number of new cases was 62 in 2012 and decreased to 44 in 2015, suggesting decline in disease burden (Table 2). Most of the patients belonged to the young age group (15 to 30 years), similar to the finding reported by Jindal et al.[8] The percentage of childhood leprosy was 7.24%, which is marginally lower than 9.6% as reported by Singal et al[9] and almost similar to that of Grover et al,[10] who reported 7.06% from a tertiary hospital located in central Delhi. This indicates that leprosy continues to be transmitted in the community.

The higher male-to-female ratio (2.4:1) in our study could be due to increased number of males migrating to cities in search of employment and lack of social perception toward female health care. Such findings on disease prevalence have been reported by other authors as well.[11,12]

The percentage of MB cases (81.1%) in our study was significantly higher than PB cases. A retrospective study of 16 years from a tertiary hospital in Delhi also showed 80.5% MB cases.[13] This is a strong indication of the fact that even today, there are inaccessible pockets of population harboring undiagnosed leprosy patients for a long time. Moreover, being a tertiary hospital in the periphery of Mumbai, we were referred patients with more severe spectrum of diseases, whereas others were effectively managed at primary or secondary health care centers.

The most frequent morphologic type was BT (45.8%), which is less than the observations made by Tiwary et al (56.9%),[13] Mahajan et al,[14] and Singh et al.[15] However, a high proportion of these BT patients were found to have MB disease (76.8% cases, n = 73/95) on investigation through slit skin smear (SSS) and biopsy. It has also been reported that among patients initially diagnosed as PB clinically, up to 38 to 51% turn out to have MB disease and, hence, are at risk of undertreatment.[15,16] Therefore, SSS should be done in all patients and if possible biopsy. This will not only confirm the diagnosis, but will also ensure accurate identification of the spectrum and features of MB involvement as early as possible for proper treatment.

The clinicohistopathological concordance of 74.7% was found in patients, which is higher than 60.6% reported by Kumar et al[17] and marginally lower than 78.8% reported by Chhabra et al.[18] About 32.8% presented with reactions; among which, 22.7% had T1R, which was

lower than that reported by Kumar et al (30.9%).[17] Most of T1R was seen in BT leprosy (51%). T2R was seen in 10.1% patients (most of whom (80.9%) belong to lepromatous spectrum), which is slightly higher than that reported by Chhabra et al (7.1%).[18] Furthermore, proportion of WHO grade 2 deformities at presentation (32.8%) was much higher than that reported by Jindal et al (17.8%).[8] These data suggest that the patients present to health care facilities when much damage has already occurred.

Limitations

The findings in this study are subject to at least two limitations. First, study was done by retrospective data analysis based on departmental records and data were limited to only those patients who reported to us, either voluntarily or on being referred. Second, being a tertiary care referral center and medical college, more patients belonging to severe spectrum of leprosy were registered, whereas other patients were managed by either primary or secondary health care center. Community-based surveys covering the district population could be more informative and exhaustive.

CONCLUSION

Although great progress has been made in elimination of leprosy, lot of work still needs to be done. We may have won the battle, but the war is still on. The high rate of MB disease (81.15%) and patients presenting with reactions and deformities (32.85%) at our tertiary referral center as compared to the national averages (52.82 and 4.61% respectively) is a big concern.

The task ahead remains difficult, with a need for strong epidemiological monitoring at all levels. As the last mile is always the hardest to go, intensified focus should be made on early case identification, prompt and complete cure, and a strengthened referral mechanism to deal with the complications and sequelae of the disease. Else the progress, we have achieved so far due to the hard work of health personnel may go waste, just at a time when success is so close.

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ORIGINAL ARTICLE

A Study of Central Venous Catheter Colonizations and Catheter-related Bloodstream Infections among Patients admitted in the Intensive Care Unit of a Tertiary Care Teaching Hospital

[1]Manish K Singh, [2]Deepanshu Mallan, [3]Shiv S Tripathi, [4]Rajiv R Yadav, [5]Sachin Avasthi

ABSTRACT

Objectives: To describe central venous catheter (CVC) colonizations and catheter-related bloodstream infections (C-RBSIs) among patients admitted in the Intensive Care Unit (ICU) of a tertiary care teaching hospital.

Materials and methods: This was a cross-sectional study conducted among critically ill patients admitted in ICU. The semi-quantitative method was used for catheter tip culture. The definitions of catheter infection and colonization were based on the Centre for Disease Control Blood Stream Infection Guidelines.

Results: The study population comprised 75 ICU patients whose CVCs had been placed. The incidence of CVC-related colonizations and bloodstream infections was observed to be 42.7% (32/75) and 17.3% (13/75) respectively. Coagulase-negative staph was the most common organism found causing CVC colonization (50%) and C-RBSI (61.5%).

Conclusion: Coagulase-negative staphylococci are the most frequent microorganisms which colonize the CVC. The findings of this study may help with implementation of educational and training programs on central line-associated bloodstream infections (CLABSIs) for health care personnel and enable better management of these devices with regard to the prevention, diagnosis, and treatment of CLABSIs.

Keywords: Bloodstream infections, Central venous catheter colonizations, Intensive care unit.

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INTRODUCTION

Infection is a major factor determining clinical outcome among patients requiring intensive care unit (ICU) support. The causes of infection within ICU are multifactorial, and consequences depend on source involved, organisms associated, underlying morbidity, timeliness, and appropriateness of the treatment/interventions received. Apart from the clinical and human consequences, the health economic and infection control implications of infection within ICU are huge.[1]

Central venous catheters (CVCs) have become essential in the management of critically ill patients, as well as other patient populations who require long-term medical care.[2] Central venous catheters are used to access the vascular system for the delivery of medication, parenteral nutrition, the collection of blood samples, and hemodynamic monitoring. However, infections and noninfectious complications are frequently reported with central venous catheterization.[2] Central line-associated bloodstream infections (CLABSIs) are one of the most frequent, lethal, and costly complications of central venous catheterization; they are associated with significant morbidity and mortality. They are also the most common cause of nosocomial bacteremia.[3]

Catheter-related bloodstream infection (C-RBSI) is a severe condition with high rates of associated morbidity and mortality.[4,5] It occurs after catheter tip colonization by microorganisms progressing along both the inner and outer surface of the catheter.[6] Diagnosis of catheter tip colonization is confirmed by culturing the catheter tip after withdrawal but may be anticipated by conservative methods based on superficial cultures of hubs and the skin surrounding the catheter entry site.[7]

The aim of this study was to describe CVC colonizations and C-RBSIs among patients admitted in the ICU of a tertiary care teaching hospital.

MATERIALS AND METHODS

This was a cross-sectional study conducted among critically ill patients admitted in the ICU of a tertiary care teaching hospital. The study was approved by the Ethical

Committee of the Institute. The consent was taken from the attendant of patient. Only newly inserted CVCs placed by the anesthesiologist in the ICU were included. Once the patients discharged from the ICU or died were excluded from the study.

Methods

The catheters used were not antimicrobial coated, but were radiopaque polyurethane catheters. The catheters were inserted by the anesthesiologist with the following sterile-barrier precautions, such as use of large sterile drapes around the insertion site, surgical antiseptic hand wash and sterile gown, gloves, mask, and cap. The skin insertion site was first disinfected with 2% povidone iodine followed by isopropyl alcohol and sterile long drapes were used before infiltrating 2% xylocaine at the entry points.

All the catheters tips removed were routinely cultured. The catheters were removed using a sterile technique by an ICU nurse. The distal 5 cm segment of the catheters was cut with sterile scissors, placed in a sterile transport tube, and cultured using the semi-quantitative method described by Maki et al.[8] The definitions of catheter infection and colonization were based on the Centre for Disease Control Blood Stream Infection Guidelines.[9]

The results are presented in proportions.

RESULTS

About one-third of patients were ≤30 years (34.7%) followed by 31 to 40 (17.3%), 51 to 60 (14.7%), 41 to 50 (10.7%), and >60 (9.3%) years. More than half (68%) of patients were males (Table 1). About one-third of cases were neurosurgical (34.7%) followed by obstetrical (21.3%), acute abdominal (18.7%), and trauma (12%). The percentage of other indications for admission in ICU was less than 10% (Table 2). The incidence of central venous catheter-related colonizations and bloodstream infections was observed to be 42.7% (32/75) and 17.3% (13/75) respectively (Fig. 1).

Coagulase -ve staphylococci (CoNS) was the most common organism found causing CVC colonization (50%) and C-RBSI (61.5%) followed by *Staphylococcus aureus* and *Escherichia coli* (Table 3). The percentage of other organism was less than 10%, causing both CVC colonization and C-RBSI (Table 4).

Table 1: Age and sex distribution of patients

Age and sex	*No. (n=75)*	*%*
Age in years		
≤30	26	34.7
31–40	13	17.3
41–50	8	10.7
51–60	11	14.7
>60	7	9.3
Sex		
Male	51	68.0
Female	24	32.0

Table 2: Indication for admission in ICU

Indication	*No. (n=75)*	*%*
Neurosurgical	26	34.7
Obstetrical	16	21.3
Acute abdominal	14	18.7
Trauma	9	12.0
Respiratory	4	5.3
Neuromuscular	3	4.0
Systemic illness	3	4.0

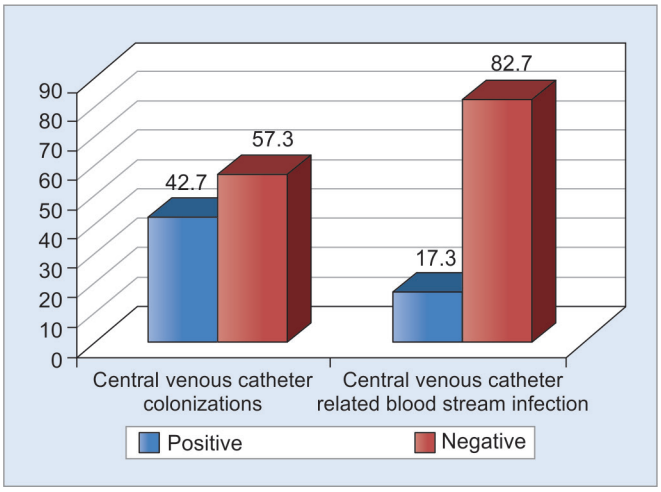

Fig. 1: Incidence of CVC-related colonizations and bloodstream infections

Table 3: Distribution of bacterial isolated from catheter trip culture and blood culture

	Central venous catheter colonizations (n=32)		*Catheter-related blood stream infections (n=13)*	
*Bacteria**	*No.*	*%*	*No.*	*%*
Coagulase –ve staph	16	50.0	8	61.5
S. aureus	7	21.9	3	23.1
E. coli	6	18.8	2	15.4
Pseudomonas	3	9.4	1	7.7
Enterobacter	2	6.3	1	7.7
Klebseilla	3	9.4	1	7.7
Candida	2	6.3	1	7.7

*Multiple response

Table 4: Incidence of CVC-related colonizations and blood stream infections

	Positive		*Negative*	
	No.	*%*	*No.*	*%*
Central venous catheter colonizations	32	42.7	43	57.3
Central venous catheter-related blood stream infections	13	17.3	62	82.7

DISCUSSION

Catheter related bloodstream infection is a major nosocomial infection with high rates of morbidity and mortality, especially in MHS-ICU patients.[10] Colonization of the catheter tip is considered a prerequisite for the development of C-RBSI, which occurs by migration of microorganisms to the catheter tip along the inner or the outer surface.[6] In clinical practice, more than 50% of the catheter tips withdrawn with suspected C-RBSI actually prove to be culture-negative in the microbiology department; i.e., noncolonized catheters are withdrawn early and unnecessarily.[6]

We found the CVC rate being 42.7%. This is similar to other studies in which the incidence rate of catheter colonization has ranged from 42 to 63%.[3,11-13]

In the present study, CoNS was the most common organism found causing CVC colonization (50%). However, in the study by Kaur et al[12] the microorganism most commonly colonizing the catheter was *S. aureus* followed by *Acinetobacter baumannii, Enterococcus faecalis, Pseudomonas aeruginosa*, non-albicans *Candida*, *E. coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and CoNS. Gahlot et al[3] found that Gram-positive cocci (40%) were the most common microorganism colonizing CVCs followed by Gram-negative non-lactose fermenting bacteria (27%), fungi (*Candida* spp. 16%), and organisms belonging to the Enterobacteriaceae family (10%).

In the present study, C-RBSI was 17.3%. Over the years, various researchers have reported an incidence of C-RBSI ranging from 2.7 to 60%. Catheter infection rate was 11.8% in a study done by Haslett et al.[14] In a multicentric study, Richet et al[15] reported an incidence rate of central catheter-associated bacteremia of 5%. Groeger et al[16] reported that the incidence of C-RBSI was ranging from 2.7 to 60%. The incidence rate of catheter sepsis in standard catheters was 7.5% in a study done by Pemberton et al.[17]

In this study, CoNS was the most common organism found causing CVC colonization (50%) and C-RBSI (61.5%) followed by *S. aureus* and *E. coli*. In a study, out of 20 isolates, 65% were CoNS. *Staphylococcus epidermidis* was the most commonly isolated CoNS comprising 45%, followed by *Staphylococcus haemolyticus* 15% and then *Staphylococcus saprophyticus* 5% of the total isolates.[18]

The main limitation of our study is its small sample size. Clinical trials are required to verify whether early withdrawal of catheters in patients with positive superficial cultures could contribute to the objective of "zero tolerance" of C-RBSI in ICUs, especially in patients with problems of vascular accessibility, coagulopathy, or severe respiratory disease to avoid the CVC removal and the risk of mechanical complications during the new canalization.

CONCLUSION

Coagulase-negative staphylococci are the most frequent microorganisms which colonize the CVC. The findings of this study may help with implementation of educational and training programs on CLABSIs for health care personnel and enable better management of these devices with regard to the prevention, diagnosis, and treatment of CLABSIs.

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ORIGINAL ARTICLE

Essential Skills in Medical Education for Students: An Online Course in Medical Education for the Doctors of Tomorrow

John Dent

ABSTRACT

There is a growing awareness of the importance of students being engaged with their medical school and curriculum. The student version of Essential Skills in Medical Education (ESME) has been designed as an accessible online course. It provides an opportunity for interested students to begin to develop understanding in this topic and seeks to motivate their further interest in the teaching role of a doctor for tomorrow.

Keywords: Medical education, Online course, Student engagement.

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INTRODUCTION

Student Engagement in the Curriculum

The extent of student engagement is a recurring theme when discussing or evaluating a medical school curriculum. Both instructions from statutory bodies, such as the General Medical Council in the United Kingdom,[1] and recognition by professional associations, such as Association for Medical Education in Europe (AMEE) in its Aspire for Excellence award[2] affirm this. The number of papers on the topic submitted to medical education conferences illustrates the extent of current interest. Other factors contributing to increasing student engagement may include the currency of self-determination, the requirement for increased accountability, and a cultural change in student attitude toward becoming a more active partner in teaching and learning rather than just a passive recipient.[3] As a result, student engagement with medical education is becoming an increasingly recognized component of medical school curricula.[4]

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In 2015, six schools (Charité – Universitätsmedizin, Germany; Utrecht University, Netherlands; University of Leeds, UK; Schulich School of Medicine & Dentistry, Canada; Uppsala University Sweden; Chulalongkorn University, Thailand) were recognized for excellence in Student Engagement in their school and curriculum and were presented with the AMEE Aspire trophy at the Annual AMEE Conference in Medical Education in Glasgow attended by around 3,500 teachers and leaders in health profession education from around the world.

Essential Skills in Medical Education Student Online Course

A further example of the current extent of student interest in medical education is supplied by the number of students who applied in January 2015 for the pilot run of an online course for students provided by AMEE, the international association for medical education. This AMEE/ESME (Essential Skills in Medical Education) course was designed to respond to the need for students to have experience in medical education, and to affirm and motivate those with an expressed interest in the teaching role of a doctor.[5] There were 150 applications from 36 countries of which we were able to enrol 70 free of charge for the pilot run in January to April 2015. There were 19 from Australia, New Zealand, Malaysia and China; 30 from the UK; and a further 21 from Europe, the Middle East, and the United States of America.

In the design of this 12-week course, we took the strengths of AMEE's very successful ESME online course[5] but presented the topics in a way which resonated with student experiences. We selected six key topics and presented these in six student modules of 2 weeks each:
Module 1: What is expected of the student as a teacher? The 12 roles of a teacher.
Module 2: What should medical students learn? Outcome-based education.
Module 3: How can learning be organized in the curriculum? The SPICES model.
Module 4: How can students learn more effectively? Part 1. The FAIR principles.
Module 5: How can students learn more effectively? Part 2. Teachers' toolkit.
Module 6: How can student learning best be tested? Student assessment.

Online webinars on each topic were delivered fortnightly by Professor Ronald Harden and Dr. John Dent (UK) and Professor Richard Hays (Tasmania). We were impressed by the students' lively participation with the presenters as well as their related chat room discussions in the background! Archived copies of each webinar were available for subsequent review. We were conscious of the many demands of undergraduate life, so aimed not to overload participants with excessive amounts of prescribed reading. We provided hard copies of the support text, "Essential Skills for Medical Teacher"[6] and online access via the MedEdWorld website to additional resource material, including AMEE Guides and booklets in the "Getting started" series.[7]

Asynchronous, discussion groups relating to the topic of each module were tutored by Richard Hays, John Dent, and Dr. Cate Kennedy (UK). The majority of students contributed several posts to the discussion groups in each module. Each module ended with a short written assignment requiring the students to review the topic from their own experiences. These assignments were reviewed by their tutors and feedback provided. It was estimated that approximately 13 hours of student time would be required for each 2-week module. Sixty-two of the 70 students successfully completed the course and were awarded the AMEE/ESME certificate registering their achievement and their interest in medical education.

In January 2016, for the second offering of the course, some refinements were made. The course was widely advertised via medical school Deans and a modest fee was levied. A total of 35 students from 12 countries were enrolled, including 11 from the University of Health Sciences, Cambodia. Following the new developments with Phnom Penh, we were able to collaborate with Dr. Thomas Fassier and Dr. Julien Aron to supply local tutoring and facilitate a discussion group in French. Thirty-one of 35 students successfully completed the course.

COURSE EVALUATION

An online questionnaire at the end of each course was completed by almost all students. Comments were positive for both the content and the delivery of the course. More than 90% found the course valuable and thought it met their expectations.

The webinars and assignments were both highly valued by 87 and 86% respectively. The discussion groups were "greatly" or "considerably" valued by 61.5%. Students enjoyed the international mix of their discussion groups. Archived copies of the webinars and the mixture of hard copy and online resources were appreciated. Interestingly, 28% thought there was capacity for more course content.

Informal Comments Included

Webinar: "Lots of opportunities for interaction and engagement within the webinar"
Discussion groups: "I developed social and interpersonal skills, communication and critical thinking through the online group discussions"
Assignments: "I enjoyed applying the concepts I learnt in the webinars and found the tutors' comments insightful and very valuable"
General: "It was a great experience not only to learn about how best to optimize medical education but also to learn how medical education is currently conducted across the world."

DISCUSSION

The certificate awarded by AMEE for completing the ESME Student course has now been recognized by six international medical schools (University of Dundee and Liverpool University, UK; University of Khartoum, Sudan; Flinders University, Australia; Pontificia Universidad Católica, Chile; and University of Hong Kong, HK) as contributing to their own diploma or masters courses in medical education. It remains to be seen to what extent successful participants will take up this opportunity to develop their interest in medical education further. Having local tutors who were able to support participants by leading discussion groups in their own language was clearly a help to those less used to conversation in English. We look forward to offering this additional resource to other French-speaking participants and to attracting tutors able to facilitate discussion groups in other languages.

CONCLUSION

The ESME Student course would appear to provide an accessible opportunity for interested students to acquire recognition for their interest in medical education and to learn more about the essential skills valuable for the teaching role of a doctor for tomorrow. The next ESME Student course will start on January 23, 2017.

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REVIEW ARTICLE

Seventy-five Years of Use of Impedance Plethysmography in Physiological Data Acquisition and Medical Diagnostics

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ABSTRACT

Impedance plethysmography (IPG) came into existence in 1940 as a result of Jan Nyboer's pioneering work in the noninvasive assessment of central and peripheral blood flow. The technique got an impetus after introduction first-time derivative of the impedance for accurate determination of stroke volume (SV) and various cardiac intervals. Later, this signal was employed by Parulkar et al for estimation of blood flow index (BFI) and differential pulse arrival time (DPAT) in various segments of the extremity, which were adequate to detect the aortic and peripheral arterial blocks and estimate collateral circulation and distal arterial runoff. The technique was widely used for measurement of respiration and body water. All these applications have resulted into use of bioimpedance for body composition analysis and continuous monitoring of cardiac output as US Food and Drug Adminstration (FDA) approved technologies, which are being used worldwide. Physiological variability has added more value to this technique as single data acquisition gives variability in heart rate and SV (or peripheral blood flow). Morphology index thus derived is very useful in screening patients suspected with coronary artery disease (CAD). All these milestones are briefly described in this paper.

Keywords: Body composition analysis, Cardiac output monitoring, Impedance plethysmography, Peripheral vascular occlusive disease, Physiological variability, Pulse morphology.

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INTRODUCTION

In the year 1940, exactly 76 years ago, Jan Nyboer introduced, for the first time, impedance plethysmography (IPG) for the noninvasive assessment of central and peripheral blood flow.[1] The literal meaning of IPG is "Recording of instantaneous volume (of an object) by measurement of its electrical impedance". During those days, ultrasound imaging was not even thought of for such assessment and plethysmography remained the method of choice for measurement of blood flow. Volume displacement plethysmography and photo plethysmography gained impetus and soon became clinically viable techniques due to their simplicity and noise-free output. Impedance plethysmography, despite its low signal-to-noise ratio, continued to be extensively used for research due to direct connectivity of electrical resistivity with hemoglobin. Also, electrical resistivity of biological materials had 500-fold variations, as shown in Table 1, which made it a very useful tool for differentiating biological tissues (Table 1).

A typical impedance-measuring system is comprised of a sine-wave oscillator followed by voltage-to-current converter. This converter outputs sinusoidal current of constant amplitude (1–3 mA) which can be passed though the body segment with the help of two band electrodes called the carrier or the current electrodes I1 and I2. Voltage signal developed along the current path is sensed with the help of another pair of electrodes, called the sensing electrodes or voltage electrodes V1 and V2 (Fig. 1). The amplitude of the signal thus obtained is directly proportional to the electrical impedance of the body segment between the electrodes V1 and V2. The amplification and detection of this signal yields an output signal, which is proportional to instantaneous impedance

Table 1: Electrical resistivity values of different biological fluids and tissues

Sl. no.	*Biological material*	*Resistivity (Ω·cm)*
1	Urine	30
2	Plasma	63
3	Cerebrospinal fluid	65
4	Blood	150
5	Skeletal muscle	300
6	Cardiac muscle	750
7	Lung	1,275
8	Fat	2,500
9	Bone	16,600

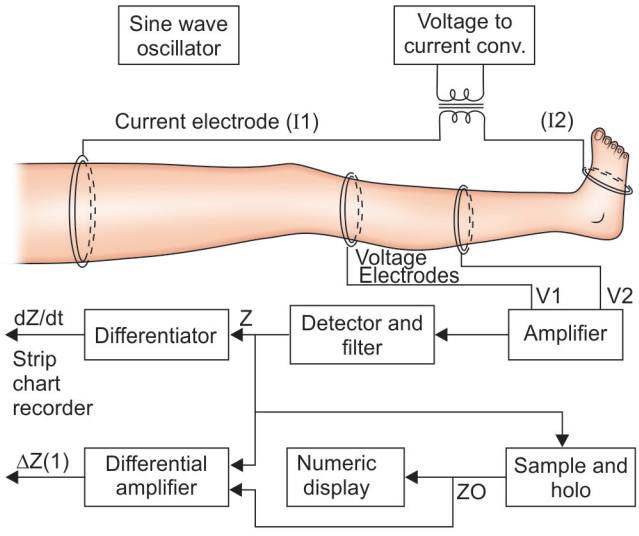


Fig. 1: Block diagram of a typical IPG system. Constant-amplitude sinusoidal current is passed through the body segment with the help of current electrodes I1 and I2. Voltage-sensing electrodes V1 and V2 are applied at desired location on the body segment along the current path. The amplitude of sensed sinusoidal signal is directly proportional to the instantaneous impedance *Z* of the body segment between the sensing electrodes. *Z* is processed electronically yield basal impedance *Zo*, Δ*Z*(*t*), and d*Z*/d*t* waveform

(*Z*) of the body segment. Initial value of the impedance, also known as basal impedance (*Zo*), is obtained from a sample and hold circuit and is numerically displayed on the panel. Small changes in the impedance of the body segment caused by physiological processes like blood circulation and respiration are obtained by subtracting the initial value of the impedance from the instantaneous impedance and is called the Δ*Z*(*t*) waveform. The *Z* is also differentiated with respect to time to get the rate of change of impedance or the d*Z*/d*t* waveform. By convention, –Δ*Z*(*t*) and –d*Z*/d*t* are recorded on a strip chart recorder to represent blood volume changes but they are colloquially called Δ*Z*(*t*) and d*Z*/d*t* waveforms.

Since d*Z*(*t*) and d*Z*/d*t* are produced by the physiological processes, it is possible to extract the changes produced by one particular process either by suppressing the other process or by signal processing techniques. For example, to extract the signal produced by blood circulation, the subject under investigation can be instructed to hold his breath. On the other hand, a low-pass filter can suppress the changes caused by blood circulation and give the changes produced by respiration. Nyboer's equation, derived from parallel conductor theory, relates the blood volume changes (Δ*V*) with the changes in electrical impedance (Δ*Z*) as follows (Nyboer 1960)[1]:

$$\Delta V = \rho b \frac{L^2}{Zo^2} \Delta Z \qquad (1)$$

where ρ*b* is the resistivity of blood in Ω·cm, L is the length between sensing electrodes and *Zo* is the gross electrical impedance of the body segment. This equation is modified appropriately to obtain stroke volume (SV)/cardiac output (CO) from d*Z*/d*t* waveform[2] and peripheral Blood flow index (BFI) from Δ*Z* waveform with the help of venous occlusion principle.[3]

$$SV = -\rho b \frac{L^2}{Zo^2} (dZ/dt)m.T \qquad (2)$$

Blood flow index in mL per 100 cc of body tissue per minute:

$$= \frac{6000}{Zo} \cdot \frac{\Delta Za}{Ta} \qquad (3)$$

where (d*Z*/d*t*)*m* is the maximum value in d*Z*/d*t* waveform, *T* is left ventricular ejection time, and Δ*Za* is the change in Δ*Z* signal in *Ta* seconds after temporary occlusion of proximal veins with the help of a tourniquet.

With joint efforts of Bhabha Atomic Research Centre (BARC), KEM Hospital, and JJ Hospital a new method for estimating peripheral blood flow from d*Z*/d*t* waveform was developed. This method was not only simple but also yielded peripheral blood flow in real time in several segments of the limb.[4] With this new method, BFI, differential pulse arrival time (DPAT) and pulse termination time (PTT) could be estimated in different segments of the limb – such as upper arm, elbow, forearm, and wrist in the upper extremity and upper thigh, knee, calf, and ankle in the lower extremity – from the basal impedance value and d*Z*/d*t* waveform recorded from the respective segment. Also coefficient of venous stasis (CVS) could be estimated by ratio of BFI in elevated position to that in supine position of the limb. Venous capacitance (VC) and maximum venous outflow (MVO) could be estimated from ΔΔ*Z*(*t*) waveform using venous occlusion principle for detecting diseases of the veins in addition to CVS and PTT.

DIAGNOSIS OF PERIPHERAL VASCULAR OCCLUSIVE DISEASES

Extensive clinical trials on 100 normal subjects and 10,000 patients with peripheral vascular occlusive diseases at KEM Hospital and JJ Hospital during 1978 to 1990, and comparison of IPG observations with angiography observations in more than 500 subjects revealed the sensitivity and specificity of the indigenously developed technique to be 96 and 98% for the diagnosis of peripheral arterial occlusive disease[5,6] and more than 80% for the diagnosis of deep vein thrombosis.[7] Typical data is shown in Figures 2 and 3 and (Table 2) respectively.

Table 2: Blood flow index and DPAT values in the lower extremities in the patient of Figure 2A

	Right side		*Left side*	
Location	*BFI*	*DPAT (ms)*	*BFI*	*DPAT (ms)*
Thigh	1.48	70	1.13	70
Knee	2.12	50	0.85	80
Calf	1.64	–	0.29	–
Ankle	1.68	40	0.23	80

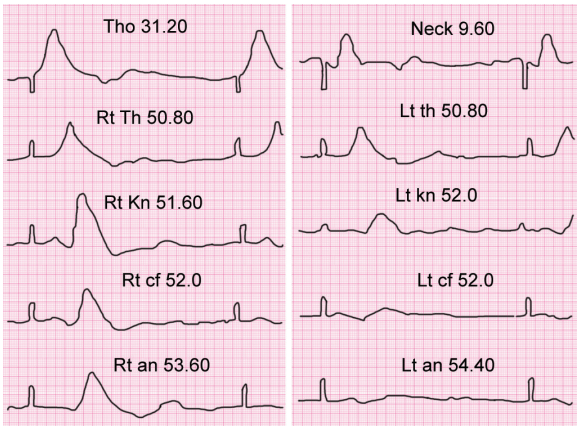


Fig. 2A: (A) Impedance cardiovasography waveforms in a patient (RKP-30-M) with femoral artery occlusion in the left leg. The amplitude of the waveform on right side gives normal appearance. Left thigh shows a marginal decrease in the amplitude of the waveform, which becomes moderately lower at knee level and markedly lower at calf and ankle levels. The BFI and DPAT values in this patient are as shown in Table 2. Blood flow index values indicate reduction in blood flow in the left leg. Increase in DPAT at left knee and further increase in the same at left ankle suggest that there is a block at thigh level in the left leg and there is also a second block below knee. Forty percent BFI at left knee, in comparison to that at right, suggests 40% collateral circulation around the proximal block and 10 to 15% distal arterial runoff

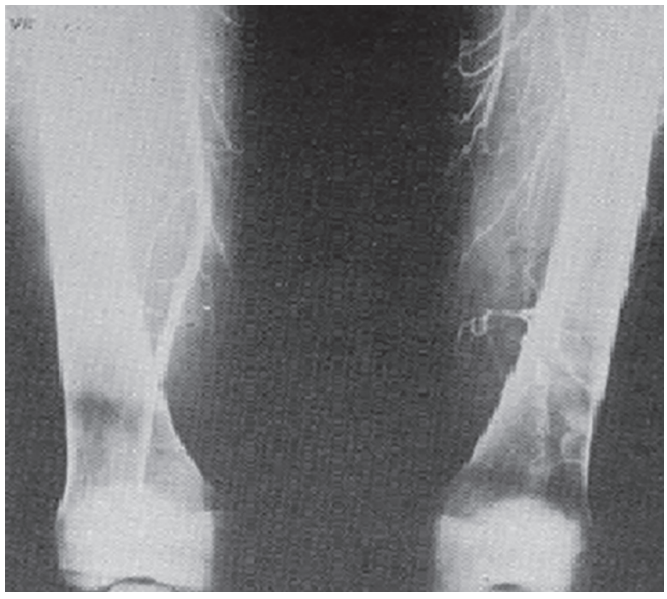


Fig. 2B: (B) Aortogram in the patient revealing left femoral artery to be narrow and irregular, profunda femoris to be markedly dilated, and complete occlusion of the superficial femoral artery. Distal part of the femoral, popliteal, and leg branches are not seen to be opacified. This data illustrates that in certain cases aortography is not in a position to give information about postocclusion blocks, which is well detected by IPG

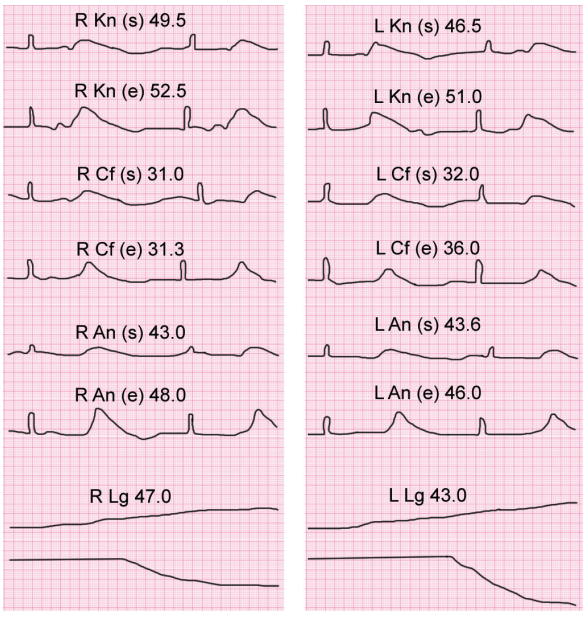


Fig. 3: Impedance cardiovasography and OIP observations in a patient (RA-32-M) with pain and swelling in both legs. The amplitude of the waveforms is seen to increase significantly on elevation of the legs at all the locations indicating varicosity of the veins. Amplitude of the Occlusive Impedance Phlebography (OIP) waveform on both sides appears to be within normal range with mild decrease in the descent of the curve. OIP observations show normal values of venous capacitance. There is a slight decrease noted in the values of Maximum Venous Outflow (MVO) in both the legs. Impedance cardiovasography and OIP observations together, therefore, suggest chronic deep-vein thrombosis in both the legs. Venography in the patient has shown patchy opacification of deep veins and muscular veins of the calf in both the legs. Proximal portion of popliteal vein, superficial femoral vein, and external iliac vein are seen to be inadequately opacified bilaterally. Secondary varicosity of great and short saphenous veins has been observed in both the legs. These observations thus confirm IPG diagnosis

CARDIAC OUTPUT MONITORING

As mentioned earlier, IPG technique has been the method of choice for the assessment of central and peripheral blood flow right from its invention. During late 1960s, Doppler ultrasonic flow meters came into existence, which were simpler to use than the comparatively cumbersome IPG. Color Doppler, introduced during late 1980s, scored heavily over IPG technique and eventually pushed it to the back seat. However, the advantages of IPG over imaging techniques, such as color Doppler were missed by nearly all the researchers. These advantages were as follows:

- It was possible to assess the collateral circulation around the vascular block by IPG. These vessels could not be assessed by color Doppler due to their small cross-sectional area and low blood velocity.
- It was possible to detect multiple blocks in a limb by IPG, which was difficult by color Doppler, again due to low blood velocity in the distal limb segment.
- Impedance plethysmography yielded total blood flow in the limb segment, which is important to know for the survival of the limb, in contrast Doppler yielded blood velocity in a particular artery.

However, for estimation of SV and CO, no other noninvasive method could overtake IPG. During the past 50 years numerable studies have been carried out on the accuracy of IPG in yielding SV and CO including those during the flight (applications in aerospace medicine). Comparison with invasive methods have shown around

Fig. 4: Graphic user interface for the IPG-based CO Monitor, developed by Electronics Division, BARC. Numerical values on the top show heart rate (HR), SV, CO, peripheral vascular resistance (PVR), respiration rate (RR), and stiffness index (SI). The upper and lower graphs show the Δ*Z* and d*Z*/d*t* waveforms respectively. Keys in the bottom can be used for viewing the trend or variability. Also, there is Log function, which converts file into text format and saves, for viewing data in some other application software

80% accuracy of IPG in the spot measurement of SV and CO. The accuracy got further deteriorated in patients with cardiac shunts and valvular regurgitation. But the studies regarding continuous monitoring of CO using IPG in comparison to invasive methods have exhibited a high degree of correlation (up to 96%).[8] Thus IPG is the method of choice for continuous monitoring of CO in critically sick patients and is the only noninvasive method. Figure 4 depicts an indigenous CO monitor developed at BARC. There have been many improvements in the Kubicek's formula for SV estimation in the past 50 years incorporating hematocrit dependence, etc.; however, not much improvement was obtained in clinical correlation. Formula given by Bernstein and Lemmens[9] in 2005 has for the first time has taken care of the huge error contributed by the square terms of *L* and *Zo* and yielded better clinical correlation.

MEASUREMENT ON RESPIRATORY SYSTEM

Atzler and Lehman were the first to report the change in electrical impedance due to respiratory activity.[10] They placed thorax of humans between plates of a capacitor which was part of their resonant circuit. The movements of thorax during respiration produce changes in the plate current of oscillator, which was recorded to characterize physiological variations. These investigators reported respiratory signal as unwanted artifact as their goal was to detect cardiac-originated signal.

Baker and Hill[11] stated that electrical impedance used successfully to monitor and detect changes in volume of fluid in thorax (e.g., pulmonary edema). Pomerantz et al[12] detected pulmonary edema in dogs which was induced by alloxan. It was detected by impedance before the clinical observation. For detecting pleural effusion in dog, they injected saline into pleural cavity and found that as low as 50 mL of saline can be detected by impedance measurement. Van de Water et al[13] proved impedance measurement to be greatly effective in monitoring intrathoracic fluid in patients. The change in impedance was found to be of the order of 2Ω per liter. Hoon et al[14] have shown fall in the thoracic impedance at height of 3,650 m.

Impedance plethysmography was also used by number of investigators for measurement of tidal volume, vital capacity, etc. and shown excellent correlation with spirometer; however, strain gauge plethysmography has scored over impedance method for the monitoring of respiration due to ease of putting transducer/electrodes on the body for longer intervals of time. During *in vivo* imaging of cardiac-related impedance changes, Eyuboglu et al[15] have obtained tomographic view of the lungs for detailed study of the lungs.

BODY COMPOSITION ANALYSIS

Patterson[16] determined body fluid using multiple measurements by placing the electrodes on right arm, right

leg, left arm, and left leg on the body. They observed that combining separate impedance measurements of the arms, trunk, and legs can predict total body water and body fat. Baumgartner et al[17] in a group of 153 subjects found that 70 to 75% of variation in the impedance was influenced by anthropometric factors. These were suitable predictors of impedance than the height, weight, mean skin fold thickness, or fat pattern. Schoeller and Kushner[18] suggested bioimpedance analysis is rapid, portable, reliable, and easy to operate method for body fluid measurement than the traditional anthropometric technique. A recent study by Patil et al[19] validated bioelectrical impedance of body fat mass against X-ray absorptiometry in Indian adults. The healthy subjects were analyzed by two methods, i.e., fat mass (FM) measurement by dual energy X-ray absorptiometry and by commercially available segmental multifrequency bioelectrical impedance analysis (BIA) instrument. Fat mass obtained from dual-energy X-ray absorptiometry was found to be 28.11 ± 9.30 kg against BIA measured FM of 28.12 ± 9.11 kg. This validated BIA measurement of FM in healthy subjects.

Patil et al[20,21] have also developed a prediction equation which is validated against dual X-ray absorptiometry (DXA) to predict bone mineral content (BMC) in human subjects which is helpful in screening for osteoporosis as follows:

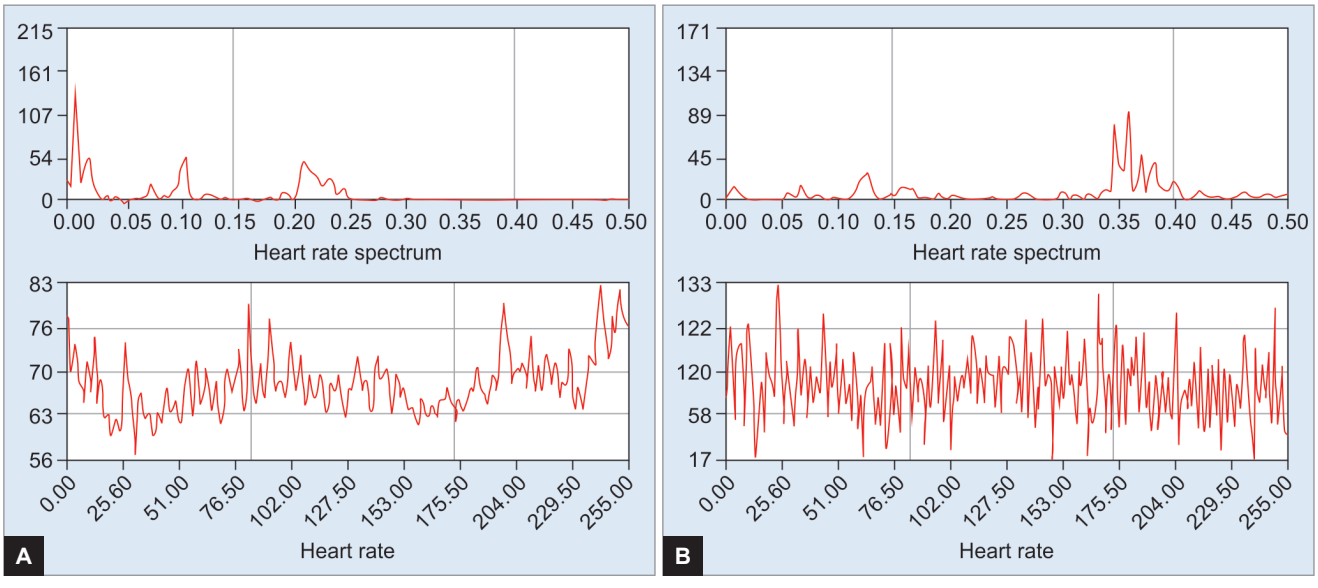
$$BMC = -3.5268 + (0.0279*h) + (0.01456*w) + (184*(h^2/Z_{body50})) - (1.08*(w*h^2/Z_{body6.25})) - (0.0032*(age)) - (0.103*(sex; men = 1, women = 0)),$$

where BMC is the bone mineral content in kg, h is the height in cm, w is weight in kg, age in years, Z_{body50} is body impedance at 50 kHz, and $Z_{body6.25}$ is body impedance at 6.25 kHz.

Bones in osteoporosis are less dense than normal, causing decrease in their density and increase in resistivity. The correlation obtained with their equation is observed to be 91.36% against DXA. Recently, Subramanian et al[22] have used bioimpedance technique for the assessment of visceral fat area and obtained 92% correlation with the commercial equipments. It needs further validation with respect to computed tomography (CT) or magnetic resonance imaging (MRI). The advantage of BIA measurement is that it can be performed on a given subject any number of times without causing any harm or discomfort to the subject.

PHYSIOLOGICAL VARIABILITY

The clinical applications of IPG do not end with measurement of central and peripheral blood flow, but more important applications are in advance stages of development at several institutes. For instance, the fluctuations in peripheral blood flow or CO are being explored to study the effect of different diseases on the autonomic nervous system (ANS). In this application, continuous IPG signal is recorded from a body segment for a period of 5 minutes. Blood flow index values are then obtained as a function of time from this signal and interpolated to get equispaced values. Fourier transform of this time series then gives the periodicity with which the fluctuations are taking place. Figures 5A and B shows typical heart rate fluctuations in time and frequency domain obtained from a normal subject and a patient with pulmonary tuberculosis. The peak at 0.012 Hz or below represents activity of thermoregulation/baroreceptor reflex/sympathetic nervous system and those at 0.109 and 0.236 Hz represent activity of parasympathetic nervous system and vagal slowing respectively (Fig. 5).



Figs 5A and B: Typical heart rate fluctuations in time (lower) and frequency domain (upper) in a normal subject (A) and a patient suffering from pulmonary tuberculosis (B). marked difference in the variability spectrum in (A) and (B) can evidently be seen

The Peripheral Pulse Analyzer developed at BARC (Fig. 6) is the continuation of the IPG work carried out during the past 40 years. It is used for the objective assessment of ANS under the influence of different diseases.[23] The unique feature of this system is that it yields heart rate variability, RR variability, and stroke volume/peripheral blood flow variability from a single data acquisition from the subject, which is not possible with any other commercial instrument. Preliminary study carried out on 3,000 subjects show that ANS activity gets selectively modified which may be specific for the disease. To converge this application into a diagnostic tool, data collection on large number of subjects is needed (Fig. 6).

In addition to the heart rate fluctuations, variability in peripheral blood flow and pulse morphology has been observed to be markedly modified by serious diseases. For instance, blood flow variability in HIV-positive patients is observed to be chaotic as compared to that in normals and patients with other disorders. Jindal et al[24] have used short-term Fourier transform for deriving the morphology index of peripheral pulse and demonstrated marked difference in the same in patients with coronary artery disease (CAD). It has been shown (Figs 7A to D) that the high-frequency components are significantly reduced in the presence of CAD indicating poor elasticity of the blood vessels. Morphology index thus obtained ranges between 0.3 and 0.45 in patients with CAD against that of control subjects (>0.80) (Fig. 7).

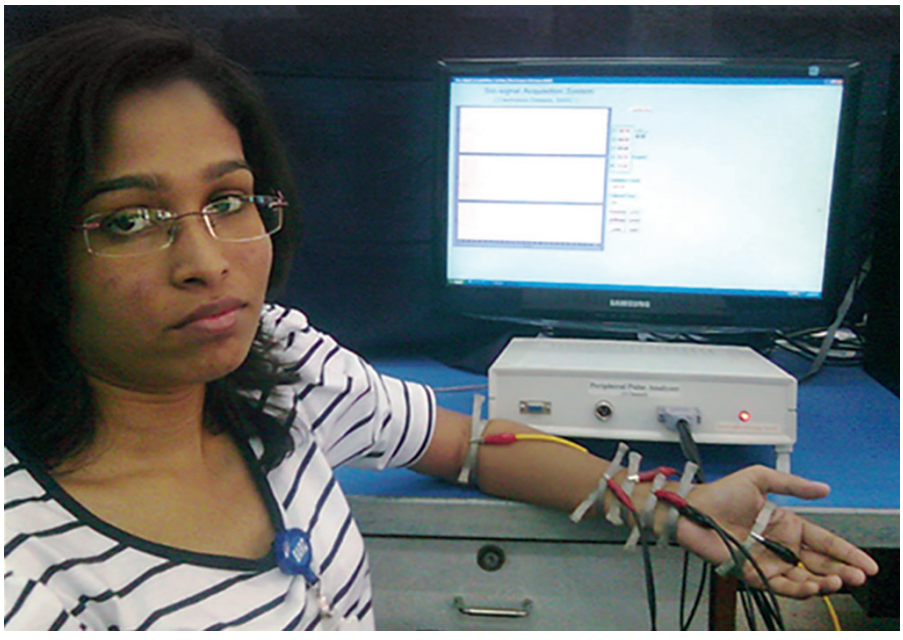
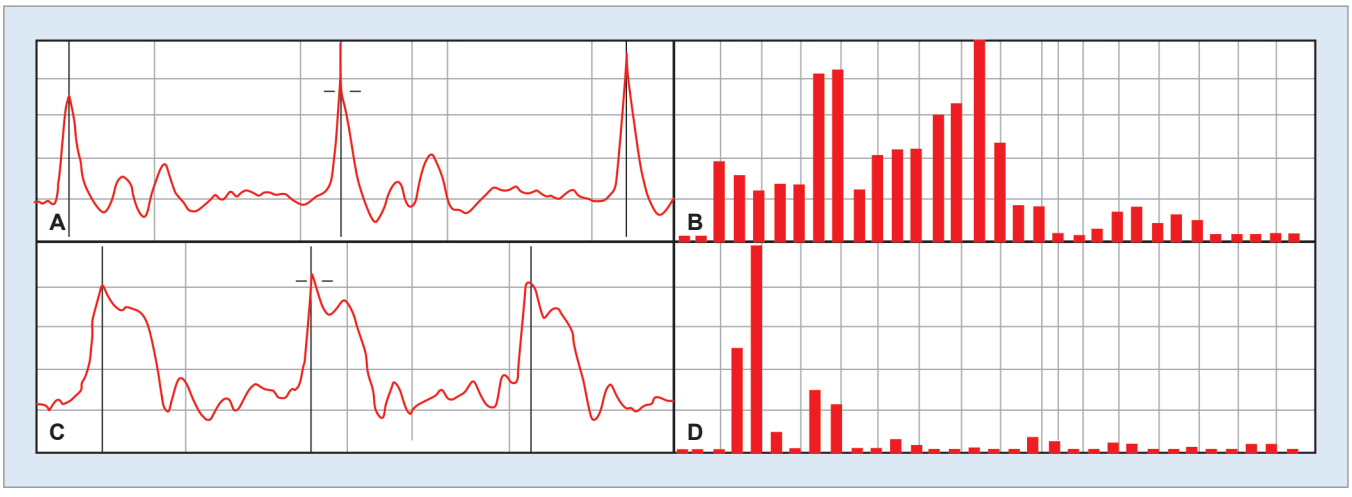


Fig. 6: Peripheral Pulse Analyzer developed at Electronics Division, BARC, is shown in action in this figure



Figs 7A to D: Peripheral pulse recorded from a normal subject (A) and a patient with severe CAD (C). The short-term fast-Fourier transform is given in (B) and (D) respectively. Absence/suppression of high-frequency components in patient with CAD in (D) can be appreciated in comparison to that in control subject in (B)

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REVIEW ARTICLE

Takayasu's Arteritis

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ABSTRACT

Takayasu's arteritis is a chronic nonspecific arteritis due to inflammatory process of the large vessels usually affecting young women. Occlusion of aorta and its various major branches can result in many of its clinical manifestations, the most devastating being stroke. As with other noninfectious inflammatory diseases, steroid remains the mainstay of treatment with many other avenues being searched for.

Keywords: Arteritis, Diagnosis, Positron emission tomography, Vasculitis.

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INTRODUCTION

Takayasu's arteritis is a rare, systemic inflammatory large vessel vasculitis that usually affects women of the childbearing age. It is defined by the Chapel Hill Consensus conference on the nomenclature of systemic vasculitis as "granulomatous inflammation of the aorta and its major branches."[1] Also known as pulse less disease or occlusive thromboarthropathy, the disease is named after the Japanese ophthalmologist who described a form of retinal arteriovenous anastomoses caused by retinal ischemia due to large vessel vasculitis in 1905.

Epidemiology

The disease is more common in Asian population with numbers as high as 150 per million in Japan.[2] The incidence is also high in India but the exact numbers are lacking. An association with the tubercle bacilli, though present, a'int much strong.[3] The median age of presentation is 25 years; however, approximately 25% of cases begin before 20 years of age and 10 to 20% present after 40 years of age.[4]

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Pathogenesis

The pathogenesis of Takayasu's arteritis starts in a genetically predisposed individual with perhaps a specific hormonal milieu, followed by an exposure to unidentified antigen leading to mounting of an immunological response that targets large vessels.[3] Macroscopically, in the chronic phase, the aorta is thickened secondary to fibrosis of all three vessel layers. The lumen is narrowed in a patchy distribution, often affecting multiple areas. If disease progression is rapid, fibrosis can be inadequate with subsequent aneurysm formation. The intima may be ridged, with a "tree bark" appearance, a feature common to many aortitides.[5]

Microscopically, the vasculitis may be divided into an acute florid inflammatory phase and a healed fibrotic phase. In the acute phase, a vasa vasoritis is seen in the adventitia. The media is infiltrated by lymphocytes and occasional giant cells with neovascularization. Mucopolysaccharides, smooth muscle cells, and fibroblasts thicken the intima. In the chronic phase there is fibrosis with destruction of elastic tissue. This can lead to aneurysm formation. Similar histopathological findings are also seen in giant cell arteritis; therefore, biopsy results may not differentiate between these two vasculitides.[6] Infiltration with gamma–delta T-cells in aortic tissues results in damage of the layers of the vessel wall by perforin. Recognition of heat shock protein 65 may result in recognition and adhesion of these cells. They have previously found restricted VαVβ gene usage of the alpha–beta T-cell receptor, suggesting that a specific antigen was being targeted. More recently, they have reported restricted usage of the VγVδ genes in the infiltrating gamma–delta T-cells, supporting their hypothesis, along with the expression of various costimulatory molecules necessary for T-cell activation.[7]

Some patients also had titers of antiendothelial antibodies, which in one study was found in 18 out of 19 patients with titers 20 times greater than the normal levels.[8] Antinuclear antibodies, antineutrophilic antibodies, or antiphospholipid antibodies were all negative in all patients with Takayasu arteritis. Accelerated atherosclerosis determined by carotid plaque and intimal thickness using Doppler studies showed higher prevalence in diseased population as compared to general population.[9]

Infection has long been thought to have a role in the pathogenesis of the disease. Tuberculosis has been particularly implicated in view of the high prevalence of infection, past or present, in affected patients[10] largely

from endemic areas. More recently, viral infection is being investigated as a trigger of vasculitis.[11] Takayasu arteritis has been associated with different human leukocyte antigen (HLA) alleles in different populations. For example, in Japan and Korea, there is a clear association with the extended haplotype: HLA B*52, DRB1*1502, DRB5*0102, DQA1*0103, DQB1*0601, DPA1*02-DPB1*0901.[12,13]

CLINICAL FEATURES

The patient of Takayasu arteritis can be completely asymptomatic, the disease being discovered on routine physical examination depicting absent pulses or may present as a devastating complication like stroke. Because of the disease process involving the upper limb arteries more than the lower limb, arm claudication is usually the first symptom. Lower limb claudication usually occurs after symptoms have started in upper limb. Bruit can be heard over the stenosed arteries but they may eventually become silent when critical stenosis develops inhibiting the turbulence. Unequal blood pressure in the arms may also be seen as subclavian steal. Advanced occlusion can lead to formation of nonhealing ulcers and gangrene, but this is uncommon given the development of collateral circulation because of the chronic nature of the disease. Arthralgias and myalgias occurred in more than half of the patients. Skin involvement occurred in the form of erythema nodosum or at times, pyoderma gangrenosum.

Other symptoms occur due to stenosis and resultant of the ischemic damage of the organ supplied. Involvement of the pulmonary artery is uncommon and can lead to pulmonary hypertension. Aortic root dilatation and resultant aortic regurgitation (AR) can occur. Myocardial infarction can occur due to coronary vasculitis. Myocarditis and pericarditis can occur but are rare. Abdominal pain can be due to mesenteric ischemia.

Rarely though, Takayasu arteritis can present as pyrexia of unknown origin months before appearance of symptoms suggestive of stenosis. Hypertension may develop in more than 50% of the patients and may be due to involvement of the renal arteries. Since the upper limb arteries are usually severely stenosed, the blood pressures need to be taken in lower limbs.[14,15]

The criteria laid down by the American College of Rheumatology for classification of Takayasu arteritis had a sensitivity of 91% and specificity of 98% for the diagnosis. Three or more criteria out of six should be fulfilled for it. The criteria are: (1) Onset before 40 years of age; (2) limb claudication; (3) decreased brachial arterial pulse; (4) unequal arm blood pressure (>10 mm Hg); (5) subclavian or aortic root bruit; and (6) angiographic evidence of narrowing or occlusion of aorta or its primary branches, or large limb arteries.[16]

Earlier, another set of criteria was proposed by Ishikawa in 1988 for the clinical diagnosis of Takayasu's arteritis. It was based on a study conducted on 108 Japanese patients. In addition to the presence of the obligatory criterion, the presence of 2 major, 4 minor, or 1 major plus 2 minor criteria suggests a high probability of Takayasu's disease with 84% sensitivity. These criteria are not widely used currently.

Obligatory Criterion

Age less than or equal to 40 years

Major Criteria

- Lesion of the left mid-subclavian artery
- Lesion of the right mid-subclavian artery.

Minor Criteria

- High erythrocyte sedimentation rate (ESR)
- Common carotid artery tenderness
- Hypertension
- Aortic regurgitation or annuloaortic ectasia
- Lesions of the pulmonary artery
- Lesions of the left mid common carotid artery
- Lesions of the distal brachiocephalic trunk
- Lesions of the thoracic aorta
- Lesions of the abdominal aorta.[17]

CLASSIFICATION OF TAKAYASU ARTERITIS

The year 1994 saw the advent of the angiographic classification of Takayasu arteritis being added into the literature.

- Type I: Branches of the aortic arch
- Type II(a): Ascending aorta, aortic arch, and its branches
- Type II(b): Ascending aorta, aortic arch and its branches, and thoracic aorta
- Type III: Thoracic, abdominal, and/or renal arteries
- Type IV: Abdominal aorta and renal arteries
- Type V: Combined type II(b) and IV.
  - Coronary and pulmonary arteries involvement can be designated as C+ or P+.[18]

The prognosis of the disease was explained by Ishikawa in his study from Japanese patients. He then proposed a classification which then helped to prognosticate the disease. The four most important complications were defined as Takayasu retinopathy, secondary hypertension, AR, and aneurysm formation, each being graded as mild/moderate or severe at the time of diagnosis. Four grades of disease are described.[19]

Group I: Uncomplicated disease, with or without pulmonary artery involvement.

Group IIA: Mild/moderate single complication together with uncomplicated disease.
Group IIB: Severe single complication together with uncomplicated disease.
Group III: Two or more complications together with uncomplicated disease.

In this study by Ishikawa, the most common cause of death was congestive heart failure or cerebrovascular accident, which was seen in groups IIB and III. All patients with AR were in group III. The 5-year survival rate in combined groups IIB and III was 70% compared with 100% in group I. The overall 5-year survival rate after diagnosis was 83.1%.

The Indian experience with this classification also gives a positive outlook toward it for quantifying the prognosis. Cumulative survival at 5 years after disease onset was 91%; after 10 years the figure was 84%, whereas event-free survival figures were 74.9 and 64% respectively. Patients with a single, mild complication or no complication at diagnosis had a 5-year event-free survival of 97% compared with 59.7% in patients with a single severe or multiple complications. No deaths occurred in patients in groups I and IIA, whereas 19.6% of patients in groups IIB and III died during follow-up, mostly from cerebrovascular disease and cardiac failure. Twenty-two major nonfatal events occurred during follow-up, with 20 of 22 occurring in groups IIB and III.[10]

LABORATORY INVESTIGATIONS

They are nonspecific and depict the inflammatory nature of the disease. Normocytic normochromic anemia is common due to cytokines causing anemia of chronic disease. Erythrocyte sedimentation rate and C-reactive protein (CRP) are elevated in active disease but not in all patients, ESR being more sensitive than CRP in detecting active disease.[20] Pentraxin-3 (PTX3) is a recently detected acute phase reactant which has a better sensitivity for detection of active disease than ESR or CRP.[21]

Imaging studies are responsible for the diagnosis of this vasculopathy. Noninvasive techniques like computed tomography (CT) and magnetic resonance imaging (MRI) are almost as sensitive as conventional angiography in detecting stenosis and mural wall changes, although the conventional method still is the gold standard. Transthoracic ultrasonography assesses the ascending aorta and transesophageal route can assess the descending aorta. These techniques can be applied when the other noninvasive techniques that are contra-indicated. Histological diagnosis is usually impractical, and histological assessment is limited to those cases undergoing revascularization procedures.

Positron emission tomography (PET) can detect areas of increased uptake in the arterial walls and preliminary results suggested it to be more sensitive and lesser than or equal to MRI in detecting arterial inflammation.[22] Its role in identifying active lesions in patients on steroid therapy is also under investigation.

DIFFERENTIAL DIAGNOSIS

Giant cell arteritis: If the same disease process of large vessel vasculitis but Michel et al[23] suggested that giant cell arteritis and Takayasu arteritis can be differentiated on clinical grounds. They found that the onset of disease at the age of 40 years was the single-most discriminatory factor. Excluding age from the analysis, ethnic background and clinical signs of upper limb vascular insufficiency, shoulder stiffness, and scalp tenderness were variables that led to correct diagnoses in 95% of patients.
Tuberculosis: Tuberculosis aortitis usually affects the descending aorta. It has been speculated that *Mycobacterium tuberculosis* can be the triggering factor through its production of super antigens, the suggested role of which is thought to be via the stimulation of autoreactive T-cells that induce vascular damage. Studies have shown a link between *M. tuberculosis* and human heat shock protein and its increased expression in vessel wall with activation of T-cells that may crossreact with the same[7,24] but other studies refute the association between the two.[3]
Syphillis: Tertiary stage of the disease may involve aorta and thus the age group is usually in the 5th or 6th decade. This disease is now but used to affect the ascending aorta and lead to severe aortic root dilataion and resultant regurgitation.
Other disease processes affecting large vessels are lupus, Behçet's, rheumatoid arthritis, spondyloarthropathies, Cogan's syndrome, and Buerger's disease, but they all have other specific features to distinguish them from Takayasu's.
Ergot poisoning: Can lead to critical limb ischemia due to intense vasospasm.
Fibromuscular dysplasia: It usually involves the smaller arteries and is without constitutional features.
Hereditary connective tissue disorders that can affect the aortic root like Marfan and Ehlers–Danlos syndrome.

TREATMENT

Prednisone is the cornerstone of treatment of the disease in its active form. Criteria to diagnose the active stage include new onset or worsening of two or more of the following:

1. Fever or other systemic features (in the absence of other cause).

2. Elevated ESR.
3. Symptoms or signs of vascular ischemia or inflammation (e.g., claudication, absent pulse).
4. Typical angiographic lesions.[4]

Prednisone (0.5–1 mg/kg/day) must be given for at least 8 to 12 weeks, followed by a gradual taper, not more than 10% of the original dose per week when remission occurs. Assessment of remission can be done by observing the decrease in acute phase reactants. The Indian Takayasu Clinical Activity score (ITAS2010) and a composite ITAS-A, which includes ESR and CRP, have been validated in over 300 patients and a quantitative score of clinical disease activity for patients monitoring has been provided.[25] If exacerbations occur, then the dose of steroid should be increased. Steroids work in approximately 50% of patients. Side effects of steroids may add on to the morbidity of the patient. Hence, steroid-sparing agents need to be added once these side effects appear or the disease does not respond. Weekly oral methotrexate (started at 0.3 mg/kg per week, with the initial dose not to exceed 15 mg/week) is a moderately effective corticosteroid-sparing drug.[26] Methotrexate can be gradually increased to 25 mg/week. The emphasis is on lowering the corticosteroid dose because methotrexate seldom allows the elimination of prednisone completely; most patients continue to require at least 5 to 10 mg/day of prednisone.

Leflunomide has been used in relapsed or refractory Takayasu's arteritis and was found to be effective in a small trial.[27] Azathioprine in doses of 2 mg/kg is well tolerated and prevents development of new angiographic lesions, as depicted in a study done in India.[28] Mycophenolate mofetil as steroid-sparing agent is promising, with two trials showing good efficacy and better steroid-sparing nature.[29,30] Its lesser side-effect profile, when compared to other immunosuppressive agents, is fascinating but further trials are required to quantify its efficacy in the disease. Small trials have shown good efficacy of antitumor necrosis factor agents, infliximab and etarnacept, in treating patients with refractory Takayasu's arteritis.[31] Relapses occur when treatment is stopped. Toclizumab, an interleukin-6 antagonist, has been found to be effective in refractory Takayasu.[32] Cyclophosphomide, in doses of 2 mg/kg, though toxic is employed when other therapies fail.

Revascularization procedures may be attempted. Indications include hypertension with critical renal artery stenosis, extremity claudication limiting activities of daily living, cerebrovascular ischemia or critical stenoses of three or more cerebral vessels, moderate AR, and cardiac ischemia with confirmed coronary artery involvement.[4] Percutaneous angioplasty is an available option. Bypass surgeries have a better rate of revascularization than angioplasty, and are used when the involved segment cannot be treated by angioplasty.[33,34]

Progressive AR may require surgical therapy either with valve replacement or with valve repair. Surgery is more difficult in this disorder since the tissue is fragile and inflamed. Mere presence of stenosis does not necessitate intervention. The gut, for example, has so rich collaterals that even critical stenoses of the celiac, superior, or inferior mesenteric arteries usually produce no symptoms and may require no surgical intervention. Moreover, many patients with arm claudication will develop collateral circulation and improve substantially over time with medical therapy alone.[15]

Surgical intervention should be deferred until remission; procedures done during active disease often produce disappointing results.[15] Takayasu's arteritis is a chronic disease with 20% of patients having a self-limited course.[15] The rest have a relapsing-remitting or progressive course requiring chronic corticosteroid and/or immunosuppressive therapy. Nearly two-thirds of patients experience new angiographic lesions. Early diagnosis with a sharp clinical suspicion helps in better management of the disease.

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CASE REPORT

Multiple Intraorbital Glass Foreign Bodies

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ABSTRACT

It is frequently difficult to identify and localize intraorbital foreign bodies despite modern-day high-resolution imaging studies. Although there can be grave complications associated with retention of organic intraorbital foreign bodies, many believe that removal of such bodies in most cases is unwarranted. A high clinical suspicion, proper choice of imaging studies, and removal by a skilled orbital surgeon probably make the risk of surgical exploration and foreign body removal less than the risk of foreign body retention. We present a case of extraconal foreign bodies (11 glass particles), which required exploration for retrieval. An initial bedside exploration led to locating two foreign bodies (glass particles of 2×2 cm and 1×1 cm size respectively). A second exploration in the ophthalmology operating theater yielded 11 foreign bodies (glass particles of various sizes) in the superior area of extraconal space.

Keywords: Computed tomography scan, Foreign body, Intraorbital, Tarsorrhaphy.

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INTRODUCTION

Recent years have been witnessing an increasing amount of traffic on the roads leading to increased risks for road traffic accidents (RTAs) to occur. India accounts for as high as 6% of the world's RTAs, although it has 1% of the world's vehicles. The RTA rate[1] of 35 per 1,000 vehicles in India is one of the highest in the world and so is the RTA fatality rate[2] of 25.3 per 10,000 vehicles. Traffic accidents were the cause of maximum number of maxillofacial injuries; most of the patients had injuries to the soft tissues of the face.[3]

Intraorbital foreign bodies usually occur after a high-velocity injury, such as gunshot or industrial accidents; more rarely they occur following trivial trauma. A retained foreign body can give rise to serious complications, the most devastating of which is loss of the eye. They can be classified according to their composition into (a) metallic, such as steel; (b) nonmetallic, which may be inorganic such as glass; and (c) organic, such as wood or vegetable matter. In general, metal and glass are well tolerated, and if not causing any symptoms or signs, may be left *in situ*, while organic matter like wood and vegetable matters are poorly tolerated, elicits an intense inflammatory reaction, and need to be removed urgently.[4]

A computed tomographic (CT) scan of orbit is the modality of choice for orbital foreign body detection and localization. Early surgical exploration and foreign body extraction greatly influence the visual prognosis and final outcome. Assessment through radiological images assists in the proper localization of the foreign body, estimation of its consistency and size, and evaluation of the response of surrounding orbital tissue. Additionally, it is useful in determining the integrity of the globe. The choice of imaging modality chiefly depends on the nature of the suspected foreign body. Plain film radiography is useful to localize radiopaque objects.[5,6] However, plain films lack the capacity to demonstrate the object details, their exact location in relation to surrounding structures, and tissue response or damage. Computed tomographic scanning has therefore been recommended as the imaging modality of choice in this situation.[7] Thin axial and coronal views of 1.0 to 1.5 mm cuts of the orbit are extremely useful to delineate the shape and for determining the composition of the foreign body.[7] However, despite being highly sensitive and specific for detection of foreign bodies, CT scans may produce false-negative results, particularly if the size of the foreign body is less than 0.5 mm, and especially in the case of wooden objects. These are better seen with magnetic resonance imaging (MRI). However, an MRI is contraindicated if the suspected foreign body is ferromagnetic.

A full thickness loss of eyelid tissue leads to lagophthalmos and corneal exposure; aggressive lubrication with antibiotic ointments is instituted or a temporary tarsorrhaphy placed until definitive repair can be accomplished.[8]

CASE REPORT

A 29-year-old female presented to the emergency room after being involved in an RTA that resulted due to brake failure after which the car in which she was traveling crashed. Patient came with facial trauma along with head injury. Patient had a spell of loss of consciousness for

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2 to 3 minutes after the accident took place. There was no history of trauma elsewhere. On examination, patient was conscious, well oriented to time, place, and person. The vitals of the patient were stable.

On inspection, injury over the temporal area measuring 10×8×4 cm was noted along with exposed bone from the temporal region of the right side. Gross facial asymmetry was noticed. The temporalis tendon was exposed. There was compressed appearance of the right temporal part of the face toward midline. Orbicularis oculi loss was noted temporally. Bone deformity could not be assessed (Fig. 1).

Systemic Examination

Central nervous system – No focal neurological deficits were noted.

Respiratory sound – Normal vesicular breath sounds heard with bilateral equal air entry.

Cardiovascular system – S_1 S_2 sounds heard, no adventitious sounds heard.

Per Abdomen – Soft, nontender, no organomegaly, no guarding or rigidity.

Ocular Examination

Vision was finger counting at 3 m of both the eyes at bedside. Extraocular movements were full in all gazes without any pain or restriction for both eyes with good Bell's phenomenon.

Anterior segment examination: Periorbital edema seen in both upper and lower eyelids of both the eyes, right eye more than left eye. Tissue loss noted on the lateral 1/3rd of both upper and lower eyelid of the right eye. Chemosis and subconjunctival hemorrhage present bilaterally. Pupillary reaction was normal with no afferent or efferent pupillary defects. Cornea appeared clear and corneal sensations present in all quadrants for both eyes, anterior chamber of normal depth and is quiet.

Posterior segment examination: Healthy optic disk with well-defined margins, cup disc ratio 0.3:1. Macula background and periphery were normal.

On palpation: Foreign bodies felt at the superior orbital margins. Two glass particles, one measuring 2×2×1 cm and the other measuring 1×0.5×0.5 cm, were retrieved. On further palpation, no foreign body could be felt. All bony margins felt intact.

Radiological Examination (Fig. 2)

Computed tomographic brain scan and orbit plain study showed the following:

- Four foreign bodies in the right parietotemporal soft tissue and within right orbit, anterosuperiorly in the extraconal compartments.
- Extraconal muscles and optic nerve appeared normal. It was found that the foreign bodies had high density values of 2000 HU (Hounsfield units).[8]
- They are located superiolaterally to the right globe.
- Significant loss of soft tissue lateral to the right orbit.

Hematological Investigations

Routine blood investigations are within normal limits.

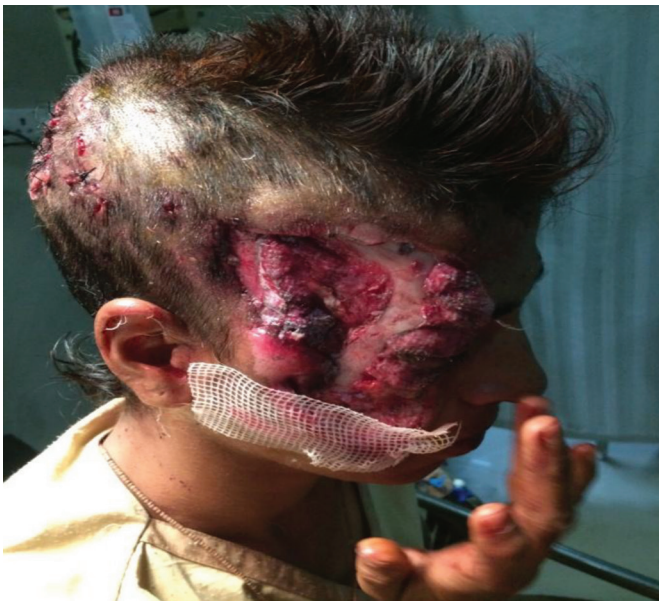

Fig. 1: Preoperative status. Note the loss of soft tissue and involvement of eyelids

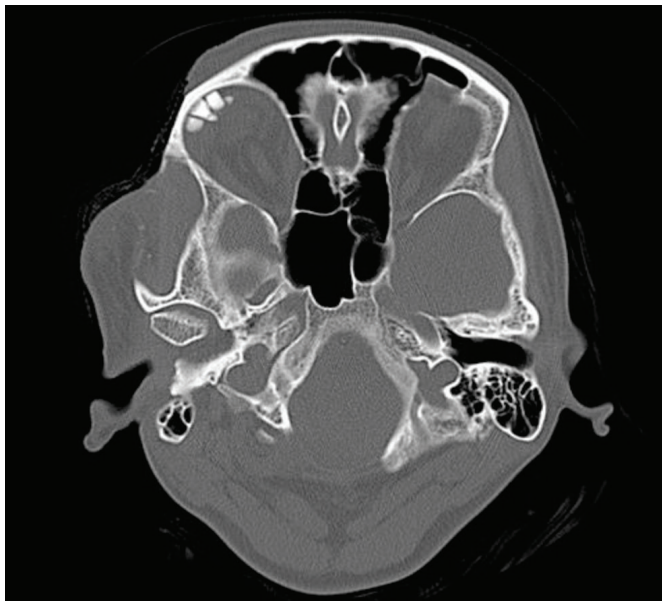

Fig. 2: Computed tomographic scan of orbit (3 × 3 mm cut) showing four inert foreign bodies in the extraconal space right eye. Note the soft tissue swelling over the right temporal region

Treatment

Patient was started on Inj. Taxim 1 gm BD, Inj. Metrogel 100 cc TDS, Inj. Emeset 4 mg SOS, Inj Dynapar 1 cc TDS, Inj. Pan 40 mg BD. IVF 1 pint DNS and 1 pint RL.

Daily dressing with saline-soaked gauze and bactigras.

Eye drop Vigamox 6 times/day, eye drops Soft drops 4 times/day, eye ointment Moxicip BD.

Plan of Action

- Exploration of the right extraconal space for foreign bodies.
- Temporary lateral tarsorrhaphy to prevent contracture after healing/granulation tissue formation.

Procedure

The patient was stabilized and was taken up for surgery as CT scan showed foreign bodies in the extraconal space of the right orbit. Exploration along with temporary lateral tarsorrhaphy was planned. On taking the patient for the exploration, no incision was required as the tissues targeted were easily accessible through the wound at the superior temporal region. As shown in Figure 3 we found three glass pieces. However, when we explored further deep below the orbicularis muscle, the forceps made a clinking noise indicating presence of more foreign bodies. On careful attempt, we were able to retrieve as many as seven glass pieces. When we made sure that no more foreign bodies were present, we closed the wound. As the posterior lamella and most of the anterior lamella was spared, we applied bolsters at the gray line after freshening the edges and performed lateral tarsorrhaphy with mersilk.

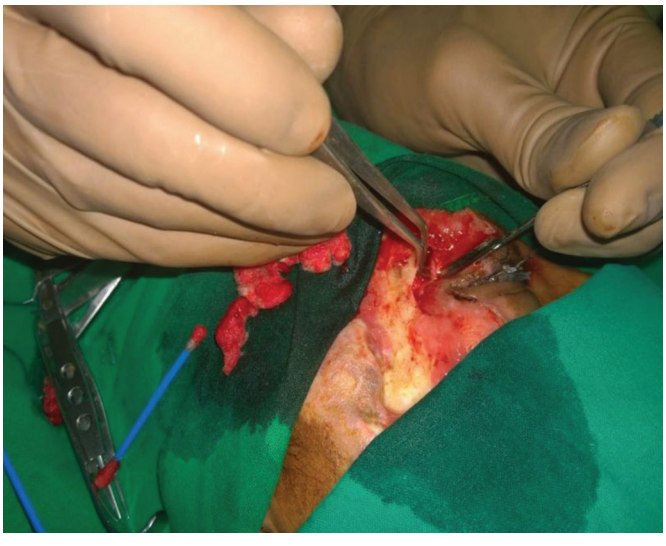

Fig. 3: Intraoperative picture

DISCUSSION

The clinical course of orbital foreign bodies differs depending on their composition. In our case, a piece of the foreign body had been removed after the initial trauma. Imaging and prompt exploration of the sinus may help in localizing and removing the foreign body. Computed tomographic scan showed foreign bodies in the extraconal space; however, CT imaging relies on the differing radiodensities of tissues for their differentiation. The radiodensity of glass is variable and may be similar to that of the orbital tissues, which may account for the potential difficulty of recognition.[9] The CT appearances seem related to the interval between injury and examination. The MRI scans are better at demonstrating wooden foreign bodies.[10] However, an MRI is contraindicated if the suspected foreign body is ferromagnetic. As we do not know the nature of foreign body in the extraconal space, MRI was not performed.

In conclusion, we would like to emphasize that intraorbital foreign bodies may often present a confusing clinical picture. It is important for the ophthalmologist, radiologist, and pathologist to include foreign body granuloma among the differentials of an intraorbital mass. It is imperative to seek past and recent history of trauma and maintain a high index of suspicion in all such cases, regardless of the interval between the trauma and current presentation.

The use of tarsorrhaphies to protect the eye in any injuries with extensive tissue loss is extremely controversial. Some surgeons believe that early tarsorrhaphies do not appear to prevent or decrease wound contracture and tissue replacement is the treatment of choice. Some surgeons perform a tarsorrhaphy early after trauma and leave it in place until the facial scars are matured believing it would prevent recurrent ectropion.[11]

It is uncertain whether combined tarsorrhaphy with skin grafting may help reduce the need for further skin grafting or recurrent ectropion. In certain circumstances, performing a small lateral tarsorrhaphy is advisable. This maintains lateral elevation and provides further blood supply to the lower eyelid.[12]

CONCLUSION

On exploration, 11 glass particles of various sizes were identified and removed from the extraconal space (as in Fig. 4 inferring that the number of CT scans can be quite deceptive in judging the number of foreign bodies). The surgeon must always thoroughly explore the concerned area owing to this fact. Although in our case the foreign bodies were glass pieces, which are inert and can be left alone, meticulous exploration is demanded as noninert foreign bodies are dangerous when left inside orbit.

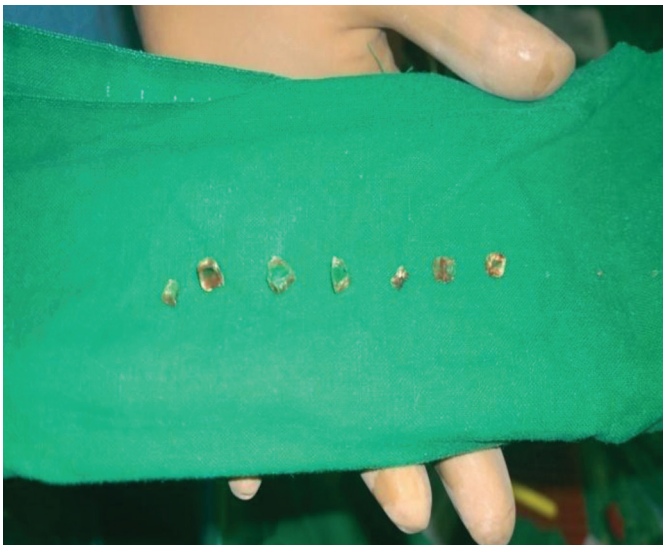

Fig. 4: Retrieved foreign bodies

The distance between foreign bodies cannot be assessed through 3 mm axial and coronal cuts.

Removal of a foreign body will reduce chances of infection or an allergic reaction. Prompt removal of the foreign body will ensure that it does not migrate to other areas of the body, or enter blood vessels. A temporary lateral tarsorraphy will prevent skin contracture maintaining the contour and length of the eyelid until the time where definitive correction is due.

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10.5005/jp-journals-10036-1099

CASE REPORT

A Rare Case of Urethral Duplication managed by Simple Meatal Correction

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[6]Rajpal Singh Lamba, [7]Nandan Pujari

ABSTRACT

Urethral duplication is a rare congenital anomaly. Although a number of theories have been proposed to describe the embryology of the condition, the actual mechanism of the disorder is still unclear. A case of urethral duplication in a 25-year-old male complaining of poor flow of urine and double stream has been discussed. The patient was treated successfully with simple meatal correction surgery.

Keywords: Abnormalities, Duplication, Urethra.

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Conflict of interest: None

INTRODUCTION

Urethral duplication is an extremely rare, yet very well-described, congenital malformation, with about 150 cases described in the specialized literature.[1] The embryology, etiology, and pathogenesis of the urethral duplication are obscure as is its management. Many different surgical approaches have been described.[2-4] One such case of urethral duplication for its rarity and controversies regarding the surgical management has been reported. A case of 25-year-old man with type II A2 urethral duplication, managed successfully by a simple meatal corrective surgery, has been described.

CASE REPORT

A 25-year-old male patient, having symptoms of poor stream of urine and straining to pass urine, visited the outpatient department. On examination, the external genitalia showed double meatal openings which were narrow (Fig. 1). Ultrasonography of abdomen showed thickened bladder wall with the presence of a large bladder diverticulum and postvoid residue of 100 mL. Urine examination showed 15 to 20 pus cells/hpf, and culture was positive for *Escherichia coli*. Serum creatinine and complete blood count were normal. The patient was treated with culture-sensitive antibiotics following which ascending urethrogram was done by injecting dye through both the meatal openings. Ascending urethrogram showed the presence of double urethra communicating at the level of posterior urethra and the presence of a bladder diverticulum (Fig. 2).

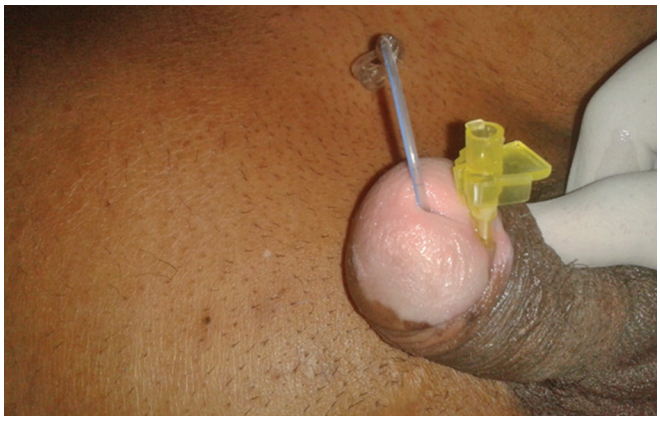

Fig. 1: Clinical photograph of patient showing presence of double meatal opening, dorsal opening admitting 6 Fr infant feeding tube, and ventral opening admitting 24 Fr venflow

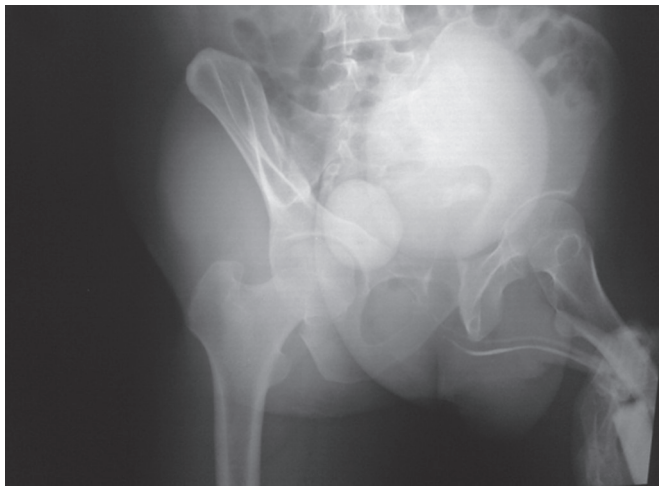

Fig. 2: Retrograde urethrogram (RUG) showing the presence of two urethra joining at the level of posterior urethra and presence of bladder diverticulum

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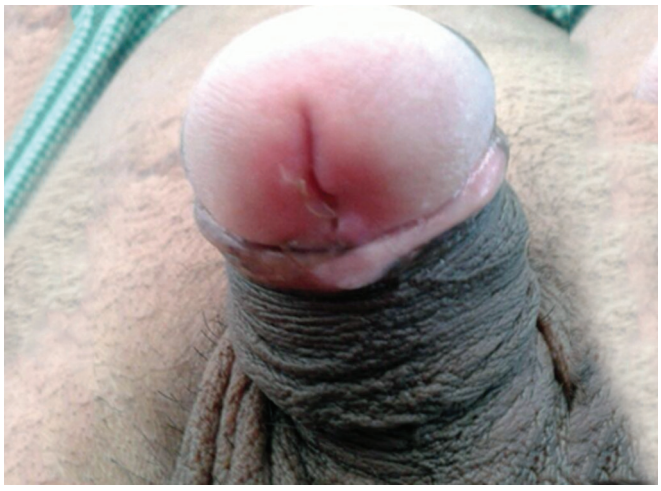


Fig. 3: Postoperative picture showing single meatus

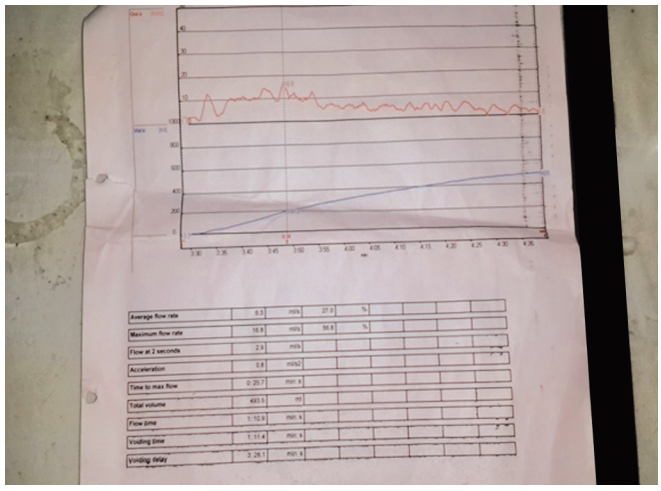


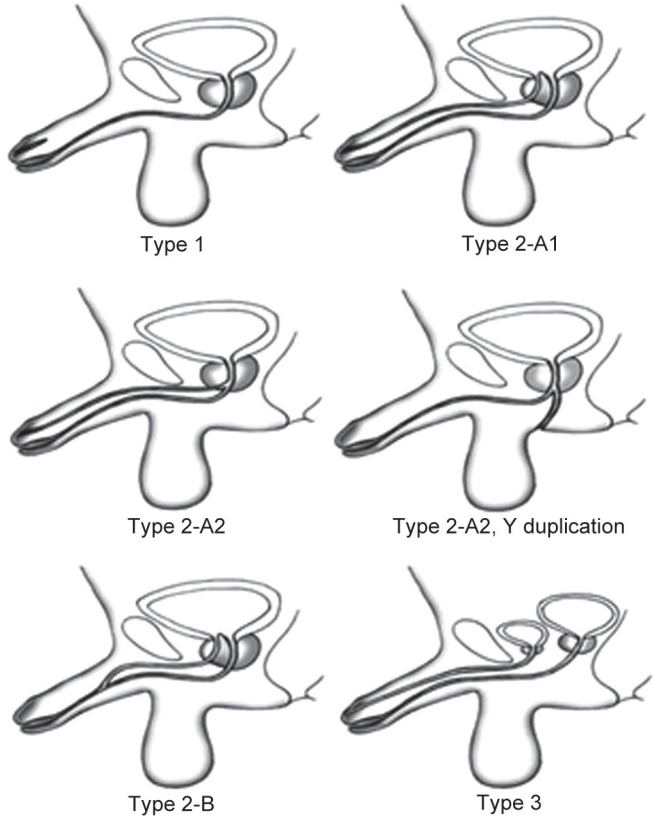
Fig. 4: Uroflowmetry showing normal flow pattern

Urethrocystoscopy was done through both the openings. Dorsal opening admitted 6 Fr ureteroscope could not be advanced in the narrow urethra, so a guide wire was passed through it and was kept in the bladder. Ventral meatus was also narrow distally and negotiable with 6 Fr ureteroscope till proximal bulbar urethra. Rest of the ventral urethra was of good lumen and mucosa appeared normal. The guide wire was seen at the level of veru and was coiled in the bladder. The septum between the dorsal and ventral meatus up to the level of navicular fossa was excised, and hemostasis was achieved with 4-0 vicryl suture. Subsequently, 17 Fr cystoscope could easily be passed through the single meatus (Fig. 3) into the ventral urethra reaching the bladder. Postoperatively, patient passed urine with single stream and good flow (Fig. 4). One-year follow-up revealed good flow and no complaints.

DISCUSSION

Urethral duplication is a rare congenital anomaly, with approximately 150 cases described in literature.[1] The anomaly is common in males with few cases reported in females. It has varied clinical manifestations, such as deformed penis, twin streams, urinary tract infection, urinary incontinence, serous discharge from sinus, outflow obstruction, and associated anamolies.[5] Embryology of the condition is unclear. Several embryological theories have been proposed.[6] Casselman and Williams stated that a partial failure or an irregularity of in-growth of the lateral mesoderm between ectodermal and endodermal layers of cloacal membrane in midline accounts for the forms with a dorsal epispadiac channel.[7] Das and Brosman reported that abnormal termination of the Müllerian duct was responsible for urethral duplication.[6] No single theory explains all the various types of abnormalities.[8]

Effmann et al[9] classified urethral duplication into three types and gave the most exhaustive description of duplication of urethra based on retrograde urethrography (Fig. 5). According to this classification, the patient belonged to type II A2. Various surgical techniques has been described, including incision of the two urethras



Type I: Blind-ending accessory urethra
Type II: Completely patent accessory urethra.
IIA1: Two non-communicating urethra arising independently from the bladder
IIA2: A second channel arising independently into a second meatus (Y duplication)
IIB: Two urethra arising from the bladder of posterior urethra and uniting to form a common channel distally.
Type III: Accessory urethra arising from duplicated or septated bladders.

Fig. 5: Effman et al classification

longitudinally along their lateral side, as well as side-to-side anastomoses of two detubularized urethra, done by Chavdar Slavov and Ivo Donkov.[2] Espinosa-Chávez[3] used 6 cm free oral mucosa graft tube and transverse pedunculated preputial flap to construct the entire urethra.

Kumar et al[4] managed Y-type duplication with single-stage operation for creation of neourethra using pedunculated perineal skin flap tube and both the urethras. In this case, excising the septum between the two urethras up to navicular fossa relieved the meatal stenosis and corrected the double stream.

CONCLUSION

Urethral duplication is a rare anomaly. Its anatomical complexity presents a great challenge with regard to surgical management. It can be concluded that simple meatal correction surgery can be a good treatment option in selected cases.

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10.5005/jp-journals-10036-1100

CASE REPORT

Anesthetic Management of Atonic Postpartum Hemorrhage with Hemorrhagic Shock and Impending Cardiac Arrest for Emergency Peripartum Hysterectomy

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ABSTRACT

Postpartum hemorrhagic complication is a critical situation for an anesthesiologist. This situation requires timely and skilful anesthetic management. A massive postpartum bleeding leading to severe hypovolemic shock may result in life-threatening cardiopulmonary arrest. The treatment of postpartum hemorrhage (PPH) has two components: First, resuscitation and control of bleeding and second, identification and management of underlying cause. Here is a case report of a 20-year-old with atonic PPH resulting in hypovolemic shock and impending cardiac arrest and successful anesthetic management for emergency peripartum hysterectomy to save the life of the patient.

Keywords: Cardiac arrest, Hypovolemic shock, Hysterectomy, Postpartum hemorrhage, Rapid sequence induction.

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Conflict of interest: None

INTRODUCTION

Postpartum hemorrhage (PPH) is defined as blood loss of more than 500 mL following vaginal delivery or more than 1000 mL following cesarean delivery. A loss of these amounts within 24 hours of delivery is termed early or primary PPH, whereas such losses are termed late or secondary PPH if they occur 24 hours after delivery.[1] The usual presentation of PPH is heavy vaginal bleeding that can quickly lead to signs and symptoms of hypovolemic shock. This rapid blood loss reflects the combination of high uterine blood flow and the most common cause of PPH, i.e., uterine atony.[2] Hypovolemia may lead to the scenario of a cardiac arrest, which is feared in the labor and delivery suite; yet, the incidence is 1 in 30,000 pregnancies.[3]

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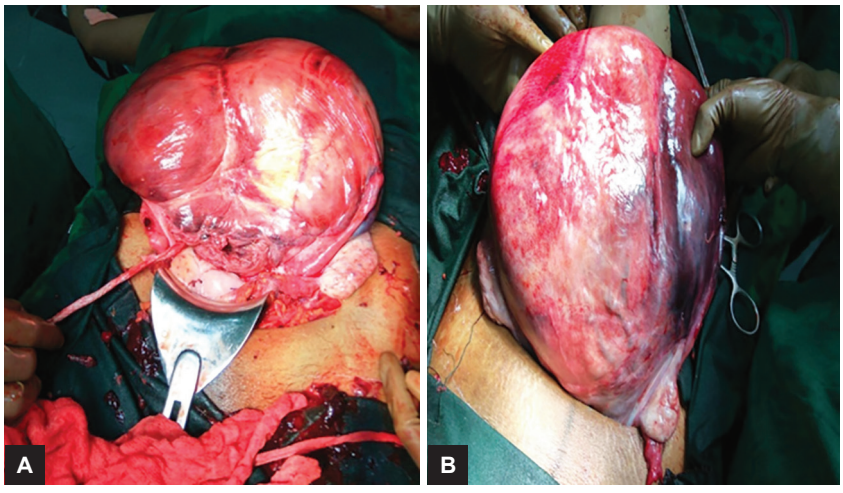
Circulatory arrest is the cessation of normal circulation of the blood due to failure of the heart to contract effectively. Resuscitation and management of obstetric hemorrhage and, possibly, hypovolemic shock and identification and management of the underlying cause(s) of the hemorrhage must be done.[4]

CASE REPORT

A 20-year-old female, with obstetric history of Gravida 1 Para 1 Live birth 1, presented with full-term pregnancy in labor. She was taken up for emergency cesarean section in view of oligohydramnios. Injection oxytocin 20 units IV and injection methergine was given intraoperatively. At 7.15 AM in the postoperative room, her uterus was intermittently relaxing and there was bleeding per vagina. Medical management of PPH was done using injection oxytocin 20 IU IV infusion. Injection carboprost 250 mg 3 doses IM were repeated over 15 minutes and tablet misoprostol 1200 mg per vagina. At about 7.55 AM, PPH was not controlled and she developed drowsiness, tachycardia, hypotension, and tachypnea, and the gynecologist planned for emergency peripartum hysterectomy.

At 8.05 AM, preanesthetic evaluation was done, patient was drowsy, not responsive, with severe pallor and thready pulse; heart rate (HR) was 160/minute; blood pressure (BP) 60 mm Hg systolic, SPO_2 was 95%; and respiratory rate (RR) was 32/minute. Complete hemogram and coagulation tests were sent on urgent basis. Blood was sent for grouping and cross matching. Patient was shifted immediately to the operation theater, two large-bore 18G IV lines were secured, and monitors attached. Patient was premedicated with injection glycopyrollate 0.2 mg IV. She was preoxygenated for 3 minutes with 100% O_2. Rapid sequence induction (RSI) was carried out. Injection pentazocine 30 mg IV, injection midazolam 1 mg IV, injection thiopentone 150 mg IV, injection ketamine 50 mg, and injection succinylcholine 100 mg IV were given. Airway was secured with no. 7 cuffed endotracheal tube. Anesthesia was maintained with O_2, intermittent vecuronium, and intermittent positive pressure ventilation. Ringer lactate and normal saline were infused. One unit of whole blood transfusion was started. Five minutes after transfusing blood, pulse was



Figs 1A and B: Flabby uterus

feeble and BP picked up to 80/46 mm Hg. Heart rate came down to 132/minute. O_2 Saturation improved to 100%. After 2 units of blood transfusion, hemodynamic parameters were stable with HR – 120/minute, BP – 130/90 mm Hg, SPO_2 – 100%; urine output was about 40 to 50 mL per hour. Blood loss was around 2300 mL, which was replaced with 5 units of ringer lactate, 1 unit of normal saline, 1 unit of voluven, 2 units of whole blood, and 4 units of fresh frozen plasma. Uterus was completely flabby and diagnosis of atonic PPH was made and surgeons went ahead with obstetric hysterectomy (Figs 1A and B). She had spontaneous breathing efforts and was reversed with injection neostigmine 3 mg and injection glycopyrollate 0.4 mg. After monitoring for 5 minutes on table for adequate efforts, patient was extubated after thorough oral suctioning. Patient was drowsy, maintained saturation with O_2 face mask at 4 L/minute, and hemodynamically stable.

She was shifted to intensive care unit for further monitoring. Postoperatively, central line was put for fluid management and central venous pressure monitoring. She was monitored for 2 hours. Her vital parameters on shifting were HR – 106/minute, BP – 140/90 mm Hg, SPO_2 – 100%, RR – 18/minute.

DISCUSSION

The usual presentation of PPH is one of heavy vaginal bleeding that can quickly lead to signs and symptoms of hypovolemic shock. This rapid blood loss reflects the combination of high uterine blood flow and the most common cause of PPH, i.e., uterine atony.[2] Rapid recognition and diagnosis of PPH are essential to successful management. Resuscitative measures and the diagnosis and treatment of the underlying cause must occur quickly before sequelae of severe hypovolemia and coagulopathy develop. The major factor in the adverse outcomes associated with severe hemorrhage is a delay in initiating appropriate management. In our case, after cesarean section, patient developed PPH, which in the initial stage was treated medically. In view of failure of these measures to control persistent bleeding and deteriorating condition of patient, decision for emergency hysterectomy was taken. Considering the hypovolemic shock, we decided to take the patient under general anesthesia in such a way that the drugs and techniques used to anesthetize the patient were optimally safe.[3] The pharmacological properties required of an intravenous induction agent that satisfies the aims of RSI, therefore, includes rapid onset and few adverse hemodynamic effects. Major cause of hypovolemia, being persistent bleeding from atonic uterus, was treated by crystalloids, colloids, and blood to preserve perfusion of vital organs.

CONCLUSION

This case emphasizes that timely intervention with efficient and coordinated team efforts results in successful outcome in a critical case of atonic PPH undergoing emergency hysterectomy.

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CASE REPORT

Chryseobacterium Indoloegenes Meningitis in a Patient with Ventriculo-peritoneal Shunt

[1]Tanushri Chatterji, [2]Anupam Das, [3]Manodeep Sen, [4]Vineeta Mittal, [5]Deepak K Singh
[6]Gaurav R Agarwal, [7]Janmejai K Srivastava, [8]Gopal Vanvani, [9]Sunanda Joshi

ABSTRACT

Chryseobacterium indologenes organism is mostly confined to water and soil and has been isolated from patients in hospitals with severe underlying disease with indwelling devices and implants. Despite its low virulence, it has been found to be inherently resistant to many antibiotics. A rare case of meningitis was reported by *C. indologenes* in an 18-year-old patient treated for hydrocephalous with meningitis with an indwelling ventriculoperitoneal shunt, who was successfully managed with levofloxacin and gentamicin and discharged. This case report describes identification and isolation of *C. indologenes* on the basis of biochemical and microbiological analysis along with clinical signs and symptoms of meningitis with an indwelling ventriculoperitoneal shunt.

Keywords: Central nervous system shunt, Cerebrospinal fluid, Chryseobacterium, Meningitis.

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INTRODUCTION

Chryseobacterium indologenes is a Gram-negative nonfermentative, nonmotile, oxidase-positive bacilli widely distributed in soil and water. In hospital environments, they have been recovered from water systems and humid surfaces. In 1993, it was first isolated from tracheal aspirate of a patient with ventilator-associated pneumonia infections caused by *C. indologenes*.[1,2] This infection is rare, but has been reported as a cause of serious infection in immune-compromised patients and patients with indwelling catheters and devices in world and Indian literature. We hereby report a case of meningitis by *C. indologenes* in an 18-year-old male with indwelling ventriculoperitoneal shunt. Attempt has been made to review the cases of meningitis and other infections from India due to *C. indolegenes*.

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AIM

The present study aimed to isolate *C. indologenes* in cerebrospinal fluid (CSF) sample that was collected from the extruded peritoneal end of a shunt with full aseptic precautions in an 18-year-old male patient at Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India.

CASE REPORT

An 18-year-old male was admitted to the hospital complaining of headache, irritability, repeated vomiting, and extruded peritoneal end of shunt. On physical examination, the patient was febrile with signs of raised intracranial tension, signs of meningeal irritation with bilateral impaired vision by the way of perception of light only. The patient had neck torticollis and was suspected of palsy. Laboratory investigations revealed hemoglobin (Hb) of 12.2 g%, total leukocytes count (TLC) 13090/cubic mm with 75% polymorphs, platelet count of 368000/µL, sodium (Na) 132, PT/INR 13.0/0.95, and random blood sugar (RBS) 97 mg/dL. Physical examination of CSF revealed slight turbid with pH of 7.5 (alkaline); on chemical examination, sugar was found to be 35 mg/dL (N 70–140 mg/dL) and microprotein level of 133.8 mg/dL (N 8–43 mg/dL). Microscopic examination of CSF exposed TLC 480 cells/cubic mm, polymorphs 55%, and mononuclear cells 45%. Cerebrospinal fluid was collected from the extruded peritoneal end of shunt with full aseptic precaution and was sent to the microbiology laboratory for culture and sensitivity, followed by Gram

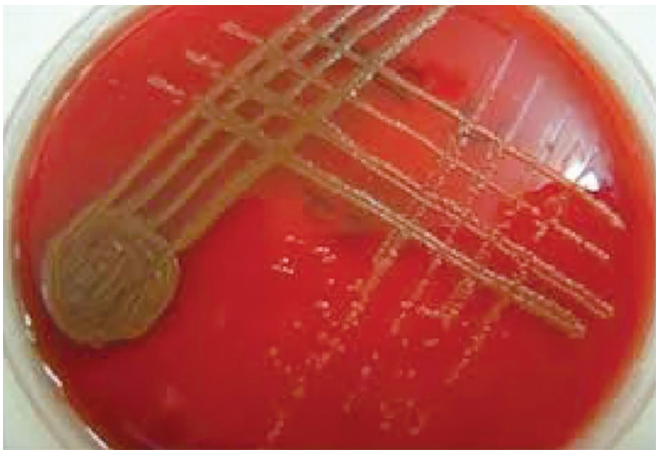

Fig. 1: Colonies of *Chryseobacterium indoloegenes* on blood agar

stain and wet mount. Gram stain of the CSF showed 2 to 8 pus cells/oil immersion field and no microorganisms were seen. Wet mount examination revealed 4 to 10 pus cells/high power fields and no microorganisms were seen. The CSF was inoculated on blood agar, MacConkey agar, and chocolate agar and incubated at 37°C in CO_2 environment. After overnight incubation, white to yellow nonhemolytic colonies of 2 to 4 mm diameter, smooth, convex with entire border were obtained (Fig. 1). The organism grown was Gram-negative bacilli that were nonmotile, catalase, and oxidase positive. The oxidative fermentative (OF) test of Hugh and Leifson yielded oxidative reaction. Light-yellow colonies were also obtained/observed in peptone water medium. The isolate was put on Vitek-2 compact automated system (BioMerieux, France) for identification. The isolate was identified as *C. indologenes* (98%, excellent identification). Antimicrobial susceptibility testing was done by Vitek-2 automated system. Antibiotic sensitivity testing intermediate (I) for gentamicin, levofloxacin, and tigecycline and susceptibility was not observed against any of the antibiotics. The resistant pattern of the antibiotics was perceived against amikacin, ampicillin-sulbactam, cefepime, ceftazidime, ceftriaxone, ciprofloxacin, imipenem, meropenem, piperacillin-tazobactam, pipracilin, tetracycline, ticarcillin, tobramycin, and trimethoprim sulfamathoxazole. The patient was further put on levofloxacin and gentamicin for 10 days. Fever subsided within 3 days of starting of the antibiotics and the patient gradually improved and follow-up of CSF culture after 10 days of antibiotic therapy did not yield any growth.

DISCUSSION

The genus *Chryseobacterium*, formerly known as *flavobacterium*, was first defined in 1994.[3] The six species of the genus *Chryseobacterium* that are more commonly isolated from clinical specimen are *C. meningosepticum, C. odoratum, C. multivorum, C. breve,* and group 11b *Chryseobacterium* spp, which includes *C. indologenes* and *C. gleum.*[4] Chryseobacteria are exogenous human pathogens and are found in the water systems, surface of equipment, and wet medical devices within the hospital.[4] We attempted a review of all the reported cases of *C. indologenes* in India (Table 1).

Strains of *Chryseobacteria* are rarely reported in infection among immunocompetent adults and this account for only 1 to 2% of Gram-negative bacilli isolated from clinical samples. It was earlier isolated in urine as well as CSF samples, which led to the cause of meningitis in neonatal patients.[5,6] The predisposing factors reported in world literature are the immunocompromised status including malignancy, neutropenia, diabetes, organ transplant, steroid use, malnutrition, and ongoing dialysis may predispose to infection.[7] The world literature cites the indwelling devices responsible for colonization, such as, respirators, endotracheal or tracheostomy tubes, mist tents, humidifiers, incubators for newborn, and syringes.[8]

CONCLUSION

Chryseobacterium indologenes should be considered as a potential pathogen that could be isolated in the presence of artificial shunt or in indwelling devices and implants in human individuals.

CLINICAL SIGNIFICANCE

Chryseobacterium indologenes, a rarely found microorganism, plays a vital role in the onset of infection, which may be further identified and treated with effective antibiotics.

ACKNOWLEDGMENT

Authors would like to be thankful to Dr. Ram Manohar Lohia Institute of Medical Sciences where the present study was conducted.

COMPLIANCE WITH ETHICAL STANDARDS

The procedures were part of a study whose ethical clearance was issued by Institutional ethics committee and the relatives/guardians of the subject were explained the implications and purpose of the study. Written and informed consent were obtained from the parents of the patient for publication of this case report and any accompanying images. The authors have no potential conflict of interest. The disclosure of potential conflict of interest in the prescribed format has been obtained from all the authors.

Table 1: Cases of *Chryseobacterium indologenes* nationally

Sl. no.	*Study*	*Year and journal*	*Age/Gender*	*Presenting compliant*	*Infection site*	*Treatment*	*Associate condition*	*Course of disease*	*Drug resistance pattern*
1	Endocarditis due to *Chryseobacterium meningosepticum.* Bomb K, Arora A, Trehan N.	Indian J Med Microbiol 2007 Apr;25(2): 161-162	58-year-old, Male	Non-ST myocardial infarction (MI) and acute left ventricular failure, with a past history diabetes mellitus (DM) and anterior wall myocardial infarct (AWMI)	Blood	Piperacillin-tazobactam, Ciprofloxacin and Rifampicin	Intraaortic balloon catheter (IABC)	Patient expired as he developed left ventricular failure with cardiogenic shock	Ampicillin-sulbactam, Ticarcillin-clavulanic acid, ticarcillin, piperacillin, cefepime, imipenem, ceftazidime, gentamicin, amikacin, and ciprofloxacin
2	*Chryseobacterium meningosepticum* bacteremia in diabetic nephropathy patient on hemodialysis. Dias M, Prashant K, Pai R, Scaria B.	Indian J Nephrol 2010 Oct;20(4): 203-204	37-year-old, Male	Known stage V diabetic nephropathy and complaints of decreased urine output, low-grade fever, and puffiness of face and pedal edema for 1 week	Blood	Vancomycin and Ceftazidime	None	Sterile blood culture reported after	Ampicillin, amoxyclav, aminoglycosides, imipenem, meropenem
3	*Chryseobacterium indologenes* bacteremia in a preterm baby. Sudharani V, Asiya, Saxena NK.	Indian J Med Microbiol 2011 Apr-Jun;29(2): 196-198	36-weeks-old baby	Delayed cry and me conium-stained liquor	Blood	Cefoperazone–sulbactam	None	Improved within 48 hours	Extended-spectrum penicillins, first-generation and second-generation cephalosporins, ceftriaxone, aztreonem, ticarcillin-clavulanate, chloramphenicol, erythromycin, aminoglycosides, imipenem, and meropenem for production of a class B carbapenem-hydrolizing enzyme
4	*Elizabethkingia meningosepticum*: An emerging cause of septicemia in critically III patients. Sarma S, Kumar N, Jha A, Baveja U, Sharma S.	J Lab Physicians 2011 Jan-Jun;3(1): 62-63	60-year-old, Female	Hepatic encephalopathy	Blood	Teicoplanin, Meropenem, and Fluconazol		Died	Ampicillin/Sulbactam, Piperacillin/Tazobactum, Ceftriaxone, Cefipime, Cefaperazone/Sulbactum, Imipenem, Meropenem, Amikacin, Gentamicin, Tobramycin, and Colistin.
5	Urinary tract infection by *Chryseobacterium indologenes*. Bhuyar G, Jain S, Shah H, Mehta VK.	Indian J Med Microbiol 2012 Jul-Sep;30(3): 370-372	19 years old, Female	Intermittent abdominal pain	Urine	Piperacillin-tazobactam	Malicot's catheter	Sterile urine culture after 10 days	Norfloxacin, ciprofloxacin, ceftazidime, cefotaxime, imipenem, aztreonam, gentamicin, amikacin, tobramycin, colistin, and polymyxin

(Contd…)

(Contd…)

Sl. no.	*Study*	*Year and journal*	*Age/Gender*	*Presenting compliant*	*Infection site*	*Treatment*	*Associate condition*	*Course of disease*	*Drug resistance pattern*
6	Nebulizer-induced superinfection and sepsis with *Chryseobacterium indologenes* in a postoperative patient with *Acinetobacter baumannii* pneumonia: A case report and review Padmaja K, Lakshmi V, Sreekanth Y, Gopinath R.	Int J Infect Control 2012;8(2)	35-years-old, Female	Jejunal perforation and underwent jejunal bypass. In the postoperative period, she developed fever, bilateral crepitations with worsening respiratory distress which progressed to acute respiratory distress syndrome (ARDS)	Tracheal aspirate and Blood	Ciprofloxacin and cotrimoxazole	Central venous catheter	Condition was improved and repeat blood cultures resulted to be sterile	Betalactams, piperacillin–tazobactum, and aminoglycosides
7	*Elizabethkingia meningoseptica*: An emerging pathogen causing meningitis in a hospitalized adult trauma patient. Tak V, Mathur P, Varghese P, Misra MC.	Indian J Med Microbiol 2013 Jul-Sep;31(3): 293-295	23-year-old, Male	Earlier patient met an accident, which led to severe head injury and had right frontotemporal contusion and intraventricular hemorrhage leading to posttraumatic hydrocephalus. After 19 days he turned up-with complain of high grade fever of 1 week and GCS score E_2 V_T M_4.	CSF	Piperacillin-tazobactam, vancomycin, and cotrimoxazole	None	After 21 days repeat CSF culture was sterile	Ampicillin-sulbactam, ticarcillin, ceftazidime, ceftriaxone, cefepime, cefoperazone–sulbactam, cefepime-tazobactam, tetracycline, chloramphenicol, imipenem, meropenem, amikacin, gentamycin, tobramycin, ciprofloxacin, levofloxacin, and colistin
8	*Elizabethkingia meningoseptica*: An unusual cause for septicemia. Swain B, Rout S, Otta S, Rakshit A.	JMM Case Rep 2014;2	58-year-old, Male	Abdominal pain for 9 days, followed by high□grade fever and abdominal distension for 7 days.	Peritoneal aspirate	Cefoperazone–sulbactam and ciprofloxacin	None	Patient died because of Septicemia	Imipenem
9	*Myroidesodoratus* and *Chryseobacterium indologenes:* Two rare isolates in the immunocompromised. Deepa R, Venkatesh KG, Parveen JD, Banu ST, Jayalakshmi G.	Indian J Med Microbiol 2014 Jul-Sep;32(3): 327-330	45-year-old, Male	Abdominal distension and swelling in both legs for 1 month, fever, and oliguria for 1 week	Ascitic fluid				Aminoglycosides and aztreonam
10	Neonatal meningitis and sepsis by *Chryseobacteruim indologenes*: A rare and resistant bacterium. Eshwara VK, Sasi A, Munim F, Purkayastha J, Lewis LE, Mukhopadhyay C.	Indian J Pediatr 2014 Jun;81(6): 611-613	6-days old, Female	Lethargic and multi focal clonic seizures. Later developed hydrocephalus	Blood and CSF	Ciprofloxacin and Co-trimoxazole	None	Recovered	Ampicillin, ampicillin-sulbactam, cefazolin, ceftriaxone, cefepime, aztreonam, meropene. Colistin, amikacin, and gentamicin

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CLINICAL PICTURE

PEELING PALMAR SKIN

A 20-year-old male presented with asymptomatic peeling of palmar skin of 1 month duration (Fig. 1). He gave history of similar episodes since 3 years, all of which occurred during the winter season and subsided without treatment in a period of 2 to 3 months. He also complained of excessive sweating over palms. There was no personal or family history of atopy. Cutaneous examination revealed exfoliation of skin over the volar aspect of the palms and fingers. Soles were spared. Palmar hyperhidrosis was also noted. Onset in adulthood, absence of itching and/or fluid-filled blisters, and negative KOH mount excluded dyshidrotic eczema, acral peeling skin syndrome, epidermolysis bullosa simplex, and dermatophytid and convened the diagnosis of keratolysis exfoliativa. Keratolysis exfoliativa is characterized by annular erythema with an air-filled blister arising in the center, followed by superficial collarette and lamellar peeling of glabrous palmoplantar skin. Synonyms include dyshidrosis lamellosa sicca and lamellar dyshidrosis. Emollients, urea, and lactic acid may be used; however, treatment is not necessary as the condition is asymptomatic.

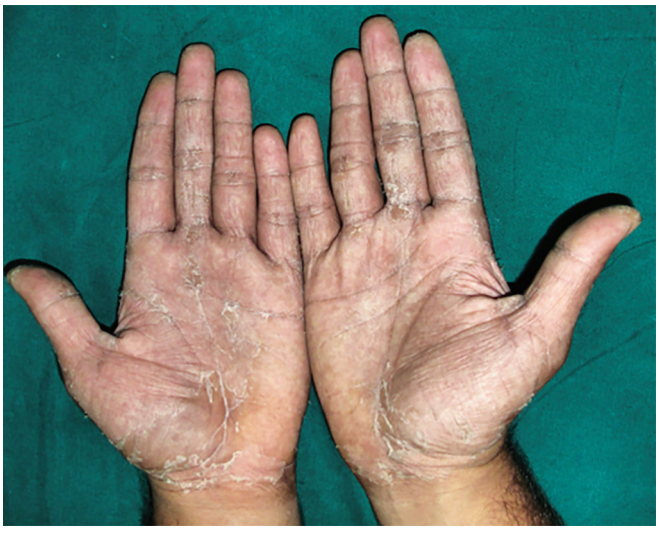

Fig. 1: Asymptomatic peeling of Palmar skin

Keywords: Keratolysis exfoliativa, Palmer, Peeling.

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