



Original Article

Audit of Paediatric Surgical Services in a Tertiary Care Hospital in Maharashtra, India

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Abstract

Objective: Aim of this study is to assess the paediatric surgical caseload, spectrum of paediatric surgical conditions managed, various paediatric surgical operative procedures performed and outcome of the same in existing set-up.

Methods: It is retrospective analysis of the paediatric surgical services provided by a single unit in a tertiary care hospital affiliated to State Government run Medical College in Maharashtra, India. The study period extends from January 2016 to December 2018. Data acquisition was done by compiling and cross-checking the computerized and non-computerized hospital records. Total 2577 children from day one old neonate up to 15 years of age with surgical disorders were included in this study. There were 1518 male children and 1059 female children. Among these, 986 were neonates.

Results: Percentage bed occupancy averaged 90%. The most common diagnoses on admission were congenital anomalies (90.25%), surgical infections (6.2%) followed by trauma (3.4%). Forty-six different operative procedures were performed. Paediatric surgical procedures accounted for 2.5% of all operations carried out in the hospital during the study period. Overall mortality was 9.1%. Peri-operative mortality was 2.9%.

Conclusions: This study aims to emphasize the spectrum of work done by paediatric surgery unit in the set up of tertiary care hospital affiliated to State Government run Medical College. It also highlights the need of strengthening the paediatric surgical services by establishing full-fledged paediatric surgery department with separate surgical ward and well-equipped surgical intensive care unit. This will ensure prompt and improved patient care and help bring down morbidity and mortality of children requiring surgical intervention.

Keywords: Audit, Paediatric Surgical Services, Congenital Anomalies, Neonatal Surgery, Tertiary Care Hospital, Childhood Injuries.

Introduction

Audit in healthcare (medical audit) is defined as the evaluation of medical care in retrospect through analysis of medical records.¹ It is a

systematic approach to review, analyze and evaluate medical care in order to identify discrepancies in the quality of care and to provide a mechanism for improving the quality.^{2,3}

The work of a basic paediatric surgical unit involves carrying out investigations to reach to a diagnosis, conservative/operative treatment of children admitted, along with peri-operative care of those undergoing surgical intervention (operation). Data on the burden of paediatric surgical diseases and utilization of paediatric surgical services in India is scarce. In light of the same, the present study aims to review the paediatric surgical caseload, spectrum of pediatric surgical conditions managed, type of paediatric surgical operative procedures performed and outcome of the services provided in the existing set-up. The study aims to objectively assess overall performance and the quality of care given to pediatric surgical patients during the study period. It is also an attempt to find out the limitations and deficiencies prevailing in the existing infrastructure. This is the first ever study of such kind from India.

Material and Methods

It is retrospective analysis of the paediatric surgical services provided by a single unit in a tertiary care hospital affiliated to State

Government run Medical College in Maharashtra, India. The study period extends from 1 January 2016 to 31 December 2018 i.e. total 3 years. Data acquisition was done by compiling and cross-checking the available hospital records viz; physical registers maintained in wards and medical record department, operation theatre log-books, hospital death audit registers, computerized OPD database and IPD records. Data collection was done diligently and confidentially after obtaining necessary permissions and approval from institutional ethics committee. Total 2577 children from day one old neonate up to 15 years of age with surgical disorders were included in this study [Table 1]. There were 1518 male children and 1059 female children. Among these, 986 were neonates. 1148 major and supramajor operations were performed on the admitted children during the study period. Approximately 89 children admitted in pediatric medical ward and pediatric medical ICU (NICU+PICU) undergoing surgical intervention during the study period are excluded from the study

Table 1- Table showing details of clinical workload of paediatric surgical unit

S.No.	Parameters	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Total of 3 years
1.	Total patients in OPD	3543	3869	4512	11924
2.	Total number of patients admitted (IPD)	629	924	1024	2577
3.	Total major Surgeries on children admitted to pediatric surgery unit	438	491	519	1148
4.	Total minor surgeries	1272	1548	1603	4423
5.	Day care surgeries	15	18	20	53

Major surgery was defined as any intervention done in the operation theatre involving incision, excision, manipulation or suturing of tissue and requiring regional or general anaesthesia or sedation. Minor surgery was defined as any procedure that did not require regional or general anaesthesia or sedation (e.g. dressing wounds or suturing lacerations under local anaesthesia).

Details of infrastructure

The institution has three qualified paediatric surgeons, two working on full time basis and one

visiting (honorary) paediatric surgeon. The surgeons are trained to manage full range of paediatric and neonatal surgical conditions. Round-o-clock support is provided by two general surgery residents on-rotation, who receive guidance by on-call paediatric surgeon.

Paediatric surgical unit providing surgical services to needy children is in operation for last 20 years. However, full-fledged separate paediatric surgery department does not exist. Paediatric surgical ward housing 30 sanctioned beds out of total 1296

hospital beds is combined with adult female surgical facilities. Neonates are managed in open ward on two newborn incubators. Paediatric surgical intensive care unit does not exist, though a dedicated medical neonatal Intensive care unit is fully operational with adequate staff and facilities. Neonatal and overall paediatric surgical peri-operative care is a challenge since the nursing staff and surgical trainees change frequently. The pediatric surgery unit receives adequate backing by the anaesthesia, radiology and paediatric department as well as an in-house blood bank and histopathology department who provide round-the-clock services. Dedicated paediatric surgical operation theatre exists since October 2016. There is central oxygen, Nitrous and suction facility. Adequate generator backup for power failures is in place. The operation theatre is fully equipped with open surgical instruments and is awaiting laparoscopic instruments. Anaesthesia delivery is done by means of modern anaesthesia equipment and monitoring. Anesthesia agents are adequately supplied.

Surgeries Performed

The unit performs major and supramajor surgeries on needy children from newborn baby who is day one old to children up to 15 years. Spectrum of surgeries performed varies from general paediatric surgery which involves herniotomy for hernia and hydrocele, orchiopexy for palpable undescended testis, circumcision, removal of minor soft tissue abnormalities and repair of umbilical hernias. Surgeries for acute abdomen like appendicectomy for appendicitis, incision and drainage of superficial abscesses, management of acute scrotum, obstructed and strangulated inguinal hernias, pyloromyotomy, intussusception reduction are routinely done. Neonatal surgeries include surgeries for malrotation correction, repair of bowel atresias, colostomy/anoplasty in anorectal malformations; repair of tracheo-esophageal fistula, congenital diaphragmatic hernia, exomphalos and gastroschisis. Complicated paediatric thoracic problems like congenital cystic adenomatoid malformations,

empyema, lung cysts are regularly managed. Expert urological surgical solutions are provided for cases like posterior urethral valves, vesicouretric reflux, urinary incontinence, hypospadias etc. Paediatric gastrointestinal and hepatobiliary conditions like duplication cyst, Hirschsprung's disease, choledochal cyst, biliary atresia are successfully handled by the unit. Repair of neurosurgical conditions like meningomyelocele, hydrocephalus are carried out; so also surgical excision of common childhood tumors like hepatoblastoma, Wilm's tumor and neuroblastoma.

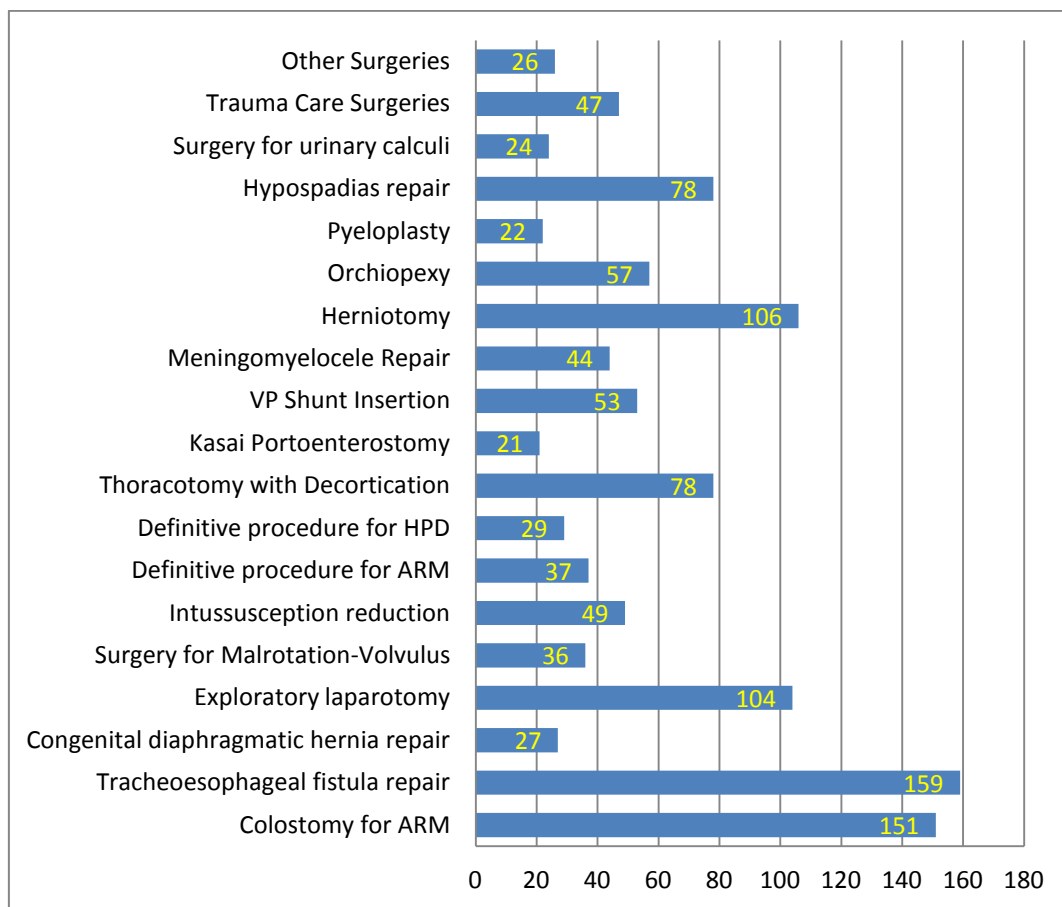
Besides above mentioned surgeries, we have successfully performed surgeries on children with major solid organ and bowel injuries resulting from motor vehicle accidents, falls and anogenital/perineal injuries inflicted by sexual abuse. Details of surgeries performed by us during the study period are as shown in **Graph 1**.

Other Activities

In addition to patient care, the paediatric surgeons have to undertake various other activities like lectures for undergraduate and nursing students, case discussions, teaching and training of surgery residents on-rotation (on-job training), infection control for the surgical team and most importantly training nurses and junior staff in perioperative care of pediatric surgical patients including neonates. We also provide antenatal counseling for prospective parents in cases where the antenatal ultrasonography has detected the baby (fetus-in-utero) having correctable congenital anomalies. Telemedicine service are provided to children from remote areas under NRHM services of the Ministry of Health and Family welfare. The faculty members have participated in various health camps organized by the state government and have offered services to OPD patients as well as operative services to needy children at local camp level. We also generate revenue for the government by enrolling and operating upon the children under the Mahatma Phule Jeevandayi Aarogya Yojana run by Maharashtra government. Our academic activities include presentations in

National/State level conferences, publication of articles in scientific journals and book

publications to create public awareness about pediatric surgical conditions.



Graph 1 - Bar diagram showing break up of surgeries performed by the paediatric surgical

Challenges

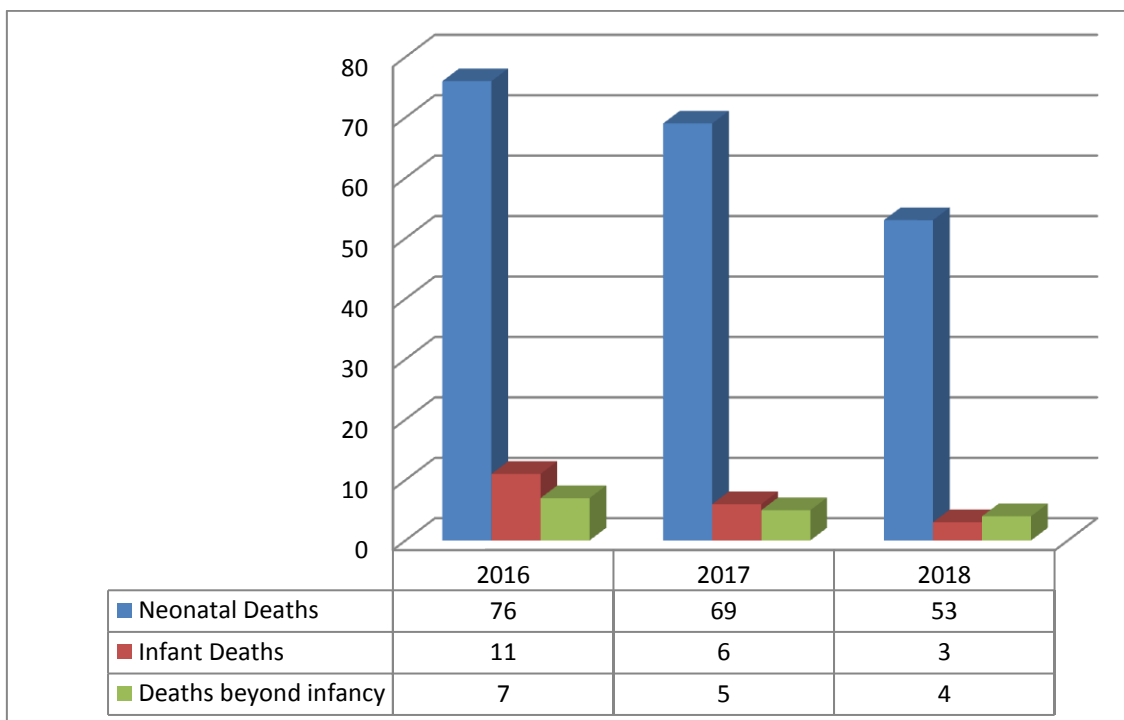
Departmental development has been challenged by frequent shuffling of trained staff, overburdened resident doctors, space constraints and lack of adequate backing by the administrators. There is shortage of personnel, drugs, equipment and general facilities for pediatric surgery. Though, electricity and running water are frequently available; blood and blood products are sometimes not available for transfusion. Non-availability of separate paediatric surgical ward and intensive care unit beds for critical paediatric surgical patients is a major challenge. Since clean pediatric surgical cases including neonates have to be managed in the same ward with septic adult patients, rates of nosocomial infections are very high and infection control strategies though in place, often show poor response.

Results

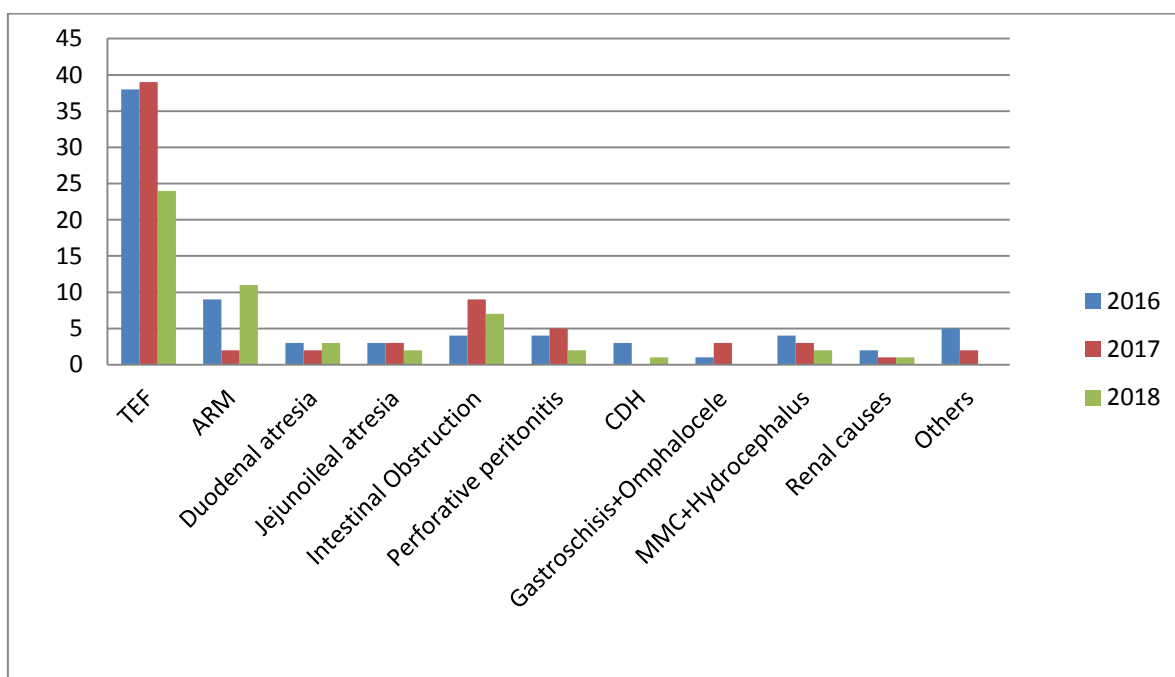
Percentage bed occupancy for pediatric surgical unit averaged 90%. The most common diagnoses on admission were congenital anomalies (90.25%), surgical infections (6.2%) followed by trauma (3.4%). Out of total 2577 children admitted, 986 were neonates. Forty-six different operative procedures were performed. Common congenital anomalies requiring neonatal admissions and operations were tracheo-esophageal fistula and anorectal malformations. 159 neonates suffering from tracheo-esophageal fistula (TEF) and 151 with anorectal malformations (ARM) underwent surgical intervention [Graph 1]. With 2.3% of total hospital beds allotted (30 beds out of 1296), paediatric surgical admissions accounted for 1% of all hospital admissions; whereas paediatric surgical procedures accounted for 2.5% of all

operations carried out in the hospital during the study period. There were total 234 deaths. Year wise distribution of deaths [Graph 2] and anomaly wise distribution of neonatal deaths [Graph 3] is shown below. Overall mortality was 91 per 1000 admissions (9.1%). Peri-operative mortality within 24 hours of surgery was 2.9%. Causes of perioperative mortality were sepsis,

respiratory failure due to lack of ventilatory support, hemodynamic instability and electrolyte imbalance because of delayed presentation and extreme prematurity. Other early complications noted were wound gape, surgical site infection, need of re-operation and prolonged post-operative stay



Graph 2- Graph showing year wise distribution of deaths in our unit



Graph 3 - Graph showing distribution of neonatal deaths v/s anomaly (year wise distribution)

Discussion

Paediatric surgery being an essential component of public health, the surgical facilities must meet certain basic standards of safe practice. The World Health Organization (WHO) Global Initiative for Emergency and Essential Surgical Care was established in 2005 to strengthen the delivery of surgical care in low-income countries.⁴ WHO has defined the types of essential and emergency surgery that should be undertaken and the kind of surgical staff, infrastructure and supplies required in three levels of health-care facilities i.e. small hospitals/health centres (level 1), district/provincial hospitals (level 2) and referral hospitals (level 3).^{5,6} Several recent surveys suggest that essential resources are not in place in rural hospitals in low-income countries.^{7,8,9}

Despite increasing awareness of the unmet burden of surgical conditions, India, a developing country, faces considerable challenges in the provision of paediatric surgical care. With 1.21 billion people, India constitutes the second most populous country in the world. Children represent 39% of India's population and those between 0-5 age group (under fives) comprise 29% of the total population. With incidence of one in every 3000-4000 live births, approximately 87,000 under five Indian children with congenital anomalies are in need of specialized pediatric surgical services.

Comprising 9.4% of the country's total population (i.e. with 96.8 million population), Maharashtra is the second most populous state of India. Hence, the burden of children with congenital anomalies (birth defects) requiring surgical correction is quite high. However, the data is scarce and little information is available on the existing facilities for surgery and anaesthesia of children.¹⁰ Hence this audit serves an important role in resource planning, besides education and research. At this juncture, it is important to note that many surgical conditions of childhood are amenable to simple surgical intervention, but if left untreated, complications like growth impairment, lifelong disability or death can ensue.¹¹ Factors which influence outcome of children suffering from

surgical conditions are the patient's physiological status (including gestational age and birth weight), disease/anomaly that requires surgical correction, nature of the operation (minor, major or supramajor) and skills and expertise of the operating team. Our patients already present late because of lack of awareness, late detection of anomaly, lack of facilities at local level requiring transfer to higher centre, financial constraints and are in compromised physiological status. In addition, there is delay in receiving the actual treatment after reaching our centre because of high patient load and lack of adequate infrastructure and manpower. Few authors have pointed out the fact that these in-hospital delays (level II delays) in provision of healthcare to neonates amount to significant morbidity and contributed to as much as 40.8% of neonatal deaths.¹² WHO data has shown that these anomalies (birth defects) contribute to 8.1% of neonatal deaths. Severe forms of congenital anomalies present during neonatal period and need early surgical correction; otherwise leading to death of the affected newborn. Such neonates requiring surgical intervention form a major chunk of patients presenting to our unit. Also, deaths of these neonates contribute to 85% of our total deaths [**Graph 4**]. Hence, to minimize the peri-operative complications including peri-operative deaths and to optimize the surgical outcome, the standard of preoperative and postoperative support services provided to these babies (neonates) at our centre need to be optimized. In addition, stress must be laid upon early referral and elective surgical intervention of these children. Since the child can live a long meaningful life after surgical correction, every attempt must be made to salvage these babies. As the first step in this context, children suffering from surgically correctable congenital anomalies (childhood surgical conditions) must be considered as part of public health problems in India as pointed out by Bilker et al in WHO Bulletin.¹³

In many studies, the common diagnoses on admission were almost proportionate for congenital anomalies, surgical infections and trauma.^{8,14} Some studies have even recorded higher percentage of trauma cases as compared to congenital anomalies.^{10,15} However in our study, percentage of congenital anomalies is far higher (90.25%) than other causes. This can be because of two reasons. As a protocol, all trauma cases are primarily admitted to general surgery department in our hospital. Only cases, requiring major surgical (thoraco-abdominal) intervention are transferred to our unit. Severe head injury cases requiring surgical intervention are managed by neurosurgery unit. As regards abscesses, our centre being a tertiary care centre, only serious cases probably reach our unit. This unique pattern of case distribution makes our beds available to cater to babies with complex congenital anomalies, who require actual paediatric surgical expertise.

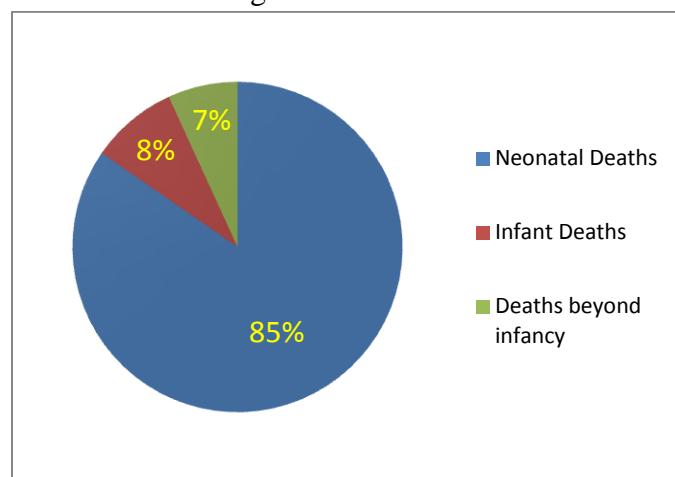
Present study shows that the rate of in-patient surgical procedures in children (as against day care procedures) is very high [Table 1]. The lack of expertise at a local level, high costs of services in private sector make children (including neonates) and their families travel long distances for care. Day care procedures are therefore not feasible. We have tried to analyze district wise distribution of cases presenting to our centre based on the addresses of individual patients maintained in our ward registers. This data brings out the fact that almost 39% patients (1006 out of 2577) presented from outside Pune. Cases were referred not only from nearby Ahmednagar, Satara, Solapur, Latur and Beed districts, but from far off districts like Jalgaon, Akola, Nandurbar and Yawatmal as well [Graph 5]. Few cases belonged to Bidar and Gulbarga districts of Karnataka. Many of these cases present at odd hours, the travel time adding onto delayed presentation. To accommodate and salvage these babies requiring emergency surgical intervention, we had to cancel our elective cases, many a times. Thus, the study also highlights vast under provision of elective paediatric surgery as

well as the need of provision of infrastructure/ manpower for running the services on 24×7 basis. Mortality rate in this study averages 91 per 1000 admissions. There were total 234 deaths, which contributed to 1.4 % of total hospital deaths. Among these, 198 were neonatal deaths and 20 were infant deaths [Graph 2]. The mortality rate is not actually representative, since it is calculated against the number of patients admitted to our ward (rather than per thousand live births) and since scoring it against per 1000 live births in the community was difficult. On the other hand, though there were more than 10,000 live births within the hospital per year, these being high risk referred cases, this data is also not representative of the community.

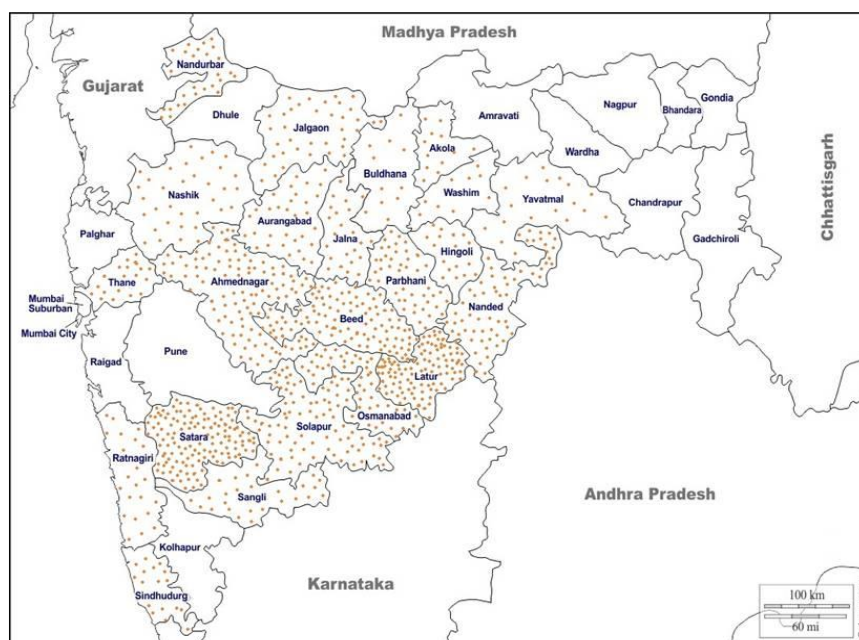
It is important to note that neonatal deaths accounted for 85% of our total deaths [Graph 4]. Common underlying anomalies noted in these babies were tracheo-esophageal fistula (TEF) and anorectal malformations (ARM) [Graph 3]. These observations bring forth the point that there is a role of strengthening the infrastructure and post-operative care provided to paediatric surgical patients (mainly neonates) to bring down neonatal deaths. Early complications because of infectious processes and sepsis were also common and required few re-operations (for burst abdomen, wound gape etc). These can be explained by the fact that we had to manage high risk neonates and infants in open wards amongst adult patients without any isolation and stringent infection control measures. Also, the unit had no selection choice for admission and all types of cases were admitted irrespective of their risk status and in fact it being a tertiary care hospital, more complex, inadequately managed and complicated cases were often referred for further management. The POSSUM (Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) scoring system for surgical audit as described by Copeland GP, Jones D and Walters M describes individual scoring based upon patients physiological parameters, hematological investigations and

intra-operative findings.^{16,17} It gives numerical prediction of mortality and morbidity for an individual patient. However, it is possible in cases of prospective studies and in retrospective studies with all the parameters properly recorded. We have not tried to do the audit based upon POSSUM scoring system since we do not have ready record summaries of individualized patient predictions which allow assessment of a patient's risk for death or complication. Also, it would really be a tedious job to trace indoor admission records of all 2577 patients and go through the records all over again to collect the requisite data. Hence, we can't correlate our morbidity and mortality data to form any definitive conclusions. However, in near future we can maintain and analyze our data more scrupulously and stringently and do our audit utilizing the POSSUM scoring system or it's modification to draw more meaningful associations and conclusions and can compare the same with current standards. Also, we would like to follow detailed trend analysis of our admissions and surgeries performed by us. Many previously published studies have concluded that factors like delay in presentation; lack of facilities, equipment and manpower resulting in delay in intervention

and prolonged in-hospital stay are predictors of patient outcome and contribute significantly to death.^{15,18} Shorter time of presentation to intervention (< 6 hrs) is found to be significantly associated with favorable outcomes.¹⁵ We would like to study these factors in detail in future studies. In spite of above limitations, it is a comprehensive study which reports the pattern and outcome of paediatric surgical admissions in a developing country. It is the first-ever study of this kind from India. It highlights the high surgical workload and brings out.



Graph 4- Pie chart showing percentage of neonatal deaths contributing to total deaths



Graph 5 -Scatter diagram showing area of residence plotted on map of Maharashtra representing district wise distribution of cases (outside Pune)- One dot represents one case

The deficiencies related to workforce, equipment and infrastructural factors like availability of separate ward and separate surgical intensive care unit beds. The surgical caseload and infrastructure being inversely proportional, it adversely affects the surgical outcome.

At a time, when the provision of healthcare in the country is being radically reorganized, it is more important than ever to understand the issues at stake and healthcare needs of the future. Strengthening of existing support services and essential ancillary services will enable us to undertake more complex surgical cases without hesitation. Specific education and competency training of the existing nursing staff in providing pre- and post-operative care will allow continuum of care and enhancement of patient care at reasonable costs. This will also be a cost effective investment in the long run. Improvement in current statistics will enable us to evolve as a centre of paediatric surgical expertise of international repute in near future.

Conclusion

This study aims to emphasize the value of on-going commitment in developing dedicated paediatric surgery department in tertiary care hospital affiliated to State Government run Medical College in Maharashtra, India. Retention of trained staff being a challenge, sustained efforts and investment in basic health-care facilities, surgical workforce and training is urgently needed. Long term commitment to provide safe and high standard services will translate into improved patient care and seems to be a sensible approach. Healthcare Quality Improvement Partnerships may be the solution in this regard. In recent times, government is taking proactive steps to identify causes of neonatal and infant deaths and also adopting stringent measures to bring down preventable neonatal and infant deaths. To enhance these efforts, it is highly advisable to strengthen existing infrastructure of paediatric surgical services across the state, so as to bring down deaths secondary to surgically correctable

congenital anomalies which form a major chunk of neonatal deaths. This recommendation may be crucial to policy formulation. Inclusion of surgical care of children (i.e. paediatric surgical services) as an essential component of all child health programmes across the country is the need of the hour.

Source of Support: Nil

Conflict of Interest: None to declare

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Key Messages

What is already Known?

- Data on the burden of paediatric surgical diseases and utilization of paediatric surgical services in India is scarce.

What this study adds?

This study throws light on the paediatric surgical caseload in Maharashtra and the vast majority of children in need of paediatric surgical operative procedures. It also highlights the need of strengthening the existing infrastructure of paediatric surgical services across the state, to bring down preventable neonatal and infant deaths.