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Epidemiology and risk factors of congenital anomalies managed by the Paediatric surgery unit at Greater Accra Regional Hospital: a three-year review

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Abstract

Purpose

Congenital anomalies contribute substantially to neonatal morbidity and mortality in low- and middle-income countries. Contemporary data on surgically managed anomalies in Ghana are limited. We aimed to quantify the prevalence, spectrum, outcomes and maternal risk factors of congenital anomalies managed by the paediatric surgery unit at Greater Accra Regional Hospital (GARH).

Methods

NICU admissions at GARH between 1 June 2022 and 30 June 2025 were retrospectively reviewed. Neonates with congenital anomalies who were managed surgically were included. Demographics, anomaly types, outcomes and maternal factors were extracted. Prevalence was summarised descriptively, and logistic regression was used to identify maternal risk factors, reported as odds ratios (ORs) with 95% confidence intervals (CIs).

Results

Among 8 015 NICU admissions, 104 neonates (1.3%) required surgical management. Gastrointestinal anomalies predominated (67.3%), notably Hirschsprung's disease or meconium plug syndrome (21.2%), anterior abdominal wall defects (19.2%) and anorectal malformations (11.5%). Overall mortality was 19.2%. Maternal age > 35 years, absent periconceptional folic acid supplementation and non-facility births were significant risk factors.

Conclusion

Surgically managed congenital anomalies at GARH were mainly gastrointestinal and carried high mortality. Promoting periconceptional folic acid use, antenatal screening, facility-based deliveries and strengthening paediatric surgical capacity may reduce preventable neonatal deaths in Ghana.

1 Introduction

Congenital anomalies are structural or functional abnormalities present at birth that contribute significantly to neonatal and under-five morbidity and mortality worldwide [1–5]. Advances in prenatal diagnosis and neonatal surgery have improved outcomes in high-income settings, yet the burden remains disproportionately high in low- and middle-income countries (LMICs) where access to timely diagnosis and definitive surgical care is limited [2,5]. More than 90% of children with serious congenital anomalies reside in LMICs [2,9].

In sub-Saharan Africa, hospital-based studies consistently report a high prevalence of surgically significant anomalies, particularly gastrointestinal, abdominal wall and neural tube defects [8–10]. In Ghana, congenital anomalies account for a notable proportion of neonatal admissions and mortality, with reports of mortality rates exceeding 30% in some centres [11–14]. Delayed presentation, limited neonatal intensive care capacity and constrained paediatric surgical resources contribute to these outcomes [11–14].

Greater Accra Regional Hospital (GARH) serves as a major referral centre for neonatal surgical conditions in southern Ghana. Understanding the local spectrum, outcomes and modifiable maternal risk factors of surgically managed congenital anomalies is essential for service planning, preventive strategies and policy development. This study therefore determined the prevalence, pattern, outcomes and maternal risk factors associated with congenital anomalies managed by the paediatric surgery unit at GARH over a three-year period.

2 Methods

2.1 Study design and setting

This retrospective cohort study reviewed medical records of neonates admitted to the neonatal intensive care unit (NICU) at GARH between 1 June 2022 and 30 June 2025. GARH is a regional referral hospital in Accra, Ghana, providing specialist neonatal and paediatric surgical services to a large urban and peri-urban population.

2.2 Inclusion and exclusion criteria

All neonates admitted to the NICU and managed by the paediatric surgery team for congenital anomalies were included. Excluded were anomalies managed by other specialties (e.g. neural tube defects managed by neurosurgery or musculoskeletal anomalies managed by orthopaedics), outpatient conditions (e.g. inguinal hernia or hypospadias) and records with more than 20% missing data.

2.3 Data collection

Data were extracted using a standardised proforma and included neonatal demographics (sex, birth weight, gestational age), type of congenital anomaly, associated anomalies and outcome (survival or death). Maternal variables included age, antenatal care attendance, periconceptional folic acid supplementation and place of delivery. Data extraction was performed independently by two investigators, with discrepancies resolved by consensus.

2.4 Statistical analysis

Categorical variables were summarised as frequencies and percentages, and continuous variables as means with standard deviations or medians with interquartile ranges, as appropriate. Prevalence was expressed as a proportion of NICU admissions and as a rate per 1 000 admissions. Logistic regression analysis was used to identify maternal risk factors associated with congenital anomalies, with results

reported as odds ratios (ORs) and 95% confidence intervals (CIs). A p-value < 0.05 was considered statistically significant.

3 Results

3.1 Prevalence and demographics

During the study period, 8 015 neonates were admitted to the NICU. Of these, 104 had congenital anomalies requiring paediatric surgical management, giving a prevalence of 1.3% (13 per 1 000 NICU admissions). The median age at admission was 2 days (interquartile range 1–5). Male neonates predominated (56.7%), followed by females (40.4%), with 2.9% having ambiguous genitalia. [Table 1]

Table 1
Prevalence and outcome of surgically managed congenital anomalies among NICU admissions

Characteristic	Value
Total NICU admissions	8,015
Neonates with congenital anomalies	104 (1.3%)
Rate per 1,000 NICU admissions	13.0
Mortality among CA cases	20 (19.2%)
Values are presented as n (%) unless otherwise stated.	

Gastrointestinal anomalies accounted for 67.3% of cases. Hirschsprung's disease or meconium plug syndrome, anterior abdominal wall defects and anorectal malformations were the most common diagnoses. Associated congenital heart disease was present in 12.5% of neonates. [Fig. 1]

3.2 Birth characteristics

More than half of the neonates (54.8%) had birth weights between 2.6 and 4.0 kg, while 43.3% were of low birth weight (< 2.5 kg). The majority (69.2%) were born between 34 and 40 weeks' gestation. [Table 2–3]

Table 2
Sex distribution of neonates with congenital anomalies

Sex	n	%
Male	59	56.7
Female	42	40.4
Ambiguous genitalia	3	2.9
Total	**104**	**100**

Table 3
Birth weight distribution

Birth weight (kg)	n	%
< 1.5	8	7.7
1.5–2.0	19	18.3
2.1–2.5	18	17.3
2.6–4.0	57	54.8
> 4.0	1	1.0
Total	**104**	**100**

3.3 Spectrum of congenital anomalies

As noted, gastrointestinal anomalies accounted for over two-thirds of cases. Hirschsprung's disease or meconium plug syndrome (21.2%), anterior abdominal wall defects (19.2%) and anorectal malformations (11.5%) were the most frequent diagnoses. Genitourinary anomalies constituted 3.8% of cases, while other anomalies, including congenital diaphragmatic hernia, accounted for 15.4%. Multiple or associated anomalies were present in 12.5% of neonates, most commonly congenital heart disease. [Table 4–5]

Table 4
Gestational age distribution

Gestational age (weeks)	n	%
< 28	5	4.8
28–33	14	13.5
34–36	33	31.7
37–40	39	37.5
> 40	13	12.5
Total	**104**	**100**

Table 5
Distribution of congenital anomaly types

Anomaly category/type	**n**	**%**
Gastrointestinal anomalies	70	67.3
– Hirschsprung's disease / meconium plug	22	21.2
– Anterior abdominal wall defects	20	19.2
– Anorectal malformations	12	11.5
– Jejunoileal atresia	11	10.6
– Duodenal atresia	6	5.8
– Malrotation	6	5.8
– Oesophageal atresia	5	4.8
Genitourinary anomalies	4	3.8
Other anomalies*	16	15.4
Associated/multiple anomalies	13	12.5
*Includes congenital diaphragmatic hernia, hydronephrosis, and others.		
Percentages exceed 100% due to multiple anomalies in some neonates.		

The commonest anomaly we saw during the study period were hirschsprung's disease (HD) and meconium plug (MP)(22 cases). These babies presented to NICU with delayed passage of meconium and abdominal distension for which a plain abdominal radiograph was done first to rule out a distal atresia and to look for absence of gas in the lower abdomen (rectum/ pelvis). Then a rectal washout was done and those who had a MP had their symptoms resolve. Those whose distension persisted had a contrast enema done which was suggestive of HD. Most of the cases of HD were managed with regular rectal irrigations till age 3 months when a full thickness rectal biopsy will be done and then pull through surgery planned. Two babies had an end colostomy done in the neonatal period as they could not decompress well on rectal irrigations only. Suction biopsy is not available here.

Anterior abdominal wall defects (AWD) formed the second highest anomalies in our study (20 cases) with omphaloceles being the most (13 cases) [12]. 10 of the cases were omphalocele majors with two of the ten presenting with associated syndromes (Beckwith -Weidemann and Edwards - diagnosed based on clinical features) Most of our patients cannot afford chromosomal studies and thus clinical signs and symptoms are relied on to make a diagnosis. All the omphalocele majors (defects 5cm and above with a huge, herniated viscera) were managed conservatively with the membrane being painted with 70% ethyl alcohol till it dried up and the baby discharged home. The resultant ventral hernia is repaired at age 3 years. There were 3 cases of omphalocele minors which were repaired in the neonatal period (day 2–3 of life) before they were discharged home, they all did well postoperatively. There were 6 cases of

gastroschisis which were all initially managed with an improvised silo (female condom) for serial bowel reduction to be done. However, one patient developed a gastric perforation for which he was operated on and the defect closed; he developed NEC postoperatively and was reoperated on and resection of most of the small bowel had to be done and died on POD 2. Most of our gastroschisis patients are delivered in other facilities and transferred to GARH for further management when the anomaly is noticed upon delivery. The care of the exposed bowel is usually poor (covered with wet gauze) and increases the risk of sepsis and malnutrition amongst these patients with resulting mortality. [Fig. 2]

Anorectal malformation (ARM) was the third highest GI anomalies seen at GARH (12 cases). 3 of these cases were ARM with a recto vestibular fistula which were decompressing well so surgery (PSARP) was delayed till age 3months. There was 1 case of ARM with a rectoperineal fistula who had primary repair (PSARP) done on day two of life. 3 cases or ARM had a rectourethral fistula (evidenced by meconium in the urine) and a divided colostomy was done in the neonatal period. Definitive surgery is planned for by age 3-6months. The other 5 cases had no obvious fistulae but had abdominal distension and a divided colostomy was done for them. A distal loopogram/colostogram will then be done later (about 3 months of age) to ascertain the anorectal anatomy. Abdominal ultrasound scan will be done as well to look for renal anomalies and an echocardiogram done if indicated. Their PSARP is then planned for. [Table 7]

Table 7
Types of Anorectal Malformation

ARM	Total
With recto vestibular fistula	3
With rectoperineal fistula	1
With rectourethral fistula	3
No fistula	5

There were 11 cases of jejunoileal atresia's (commonly jejunal atresia) of which 10 of them had laparotomy done after correction of electrolyte imbalance and dehydration. 1 baby presented to us on day 8 of life with severe dehydration and died before surgery could be done.

6 cases of malrotation of the bowel were seen and out of this number 4 had an associated midgut volvulus. Two out of the four had gangrenous bowel which was resected leading to short bowel syndrome. The other two had viable bowel after unwinding the bowel and Ladd's procedure was completed.

Another common GI anomaly seen is esophageal atresia (5 cases). Four of them had esophageal atresia with a distal TEF and were offered right thoracotomy and primary anastomosis; however primary anastomosis was only possible in 1patient intraoperatively. The others had division of the distal TEF done and converted to a staged procedure (cervical esophagostomy with feeding gastrostomy). They

will undergo definitive surgery after age 1year. One patient had a pure esophageal atresia and was offered staged procedure from the onset. [Fig. 3]

3.4 Outcomes and maternal risk factors

Overall mortality among neonates with congenital anomalies was 19.2%. Mortality was highest among those with abdominal wall defects and anorectal malformations. In multivariable logistic regression analysis, significant maternal risk factors included maternal age greater than 35 years (OR 2.3, 95% CI 1.14–4.63), lack of periconceptional folic acid supplementation (OR 2.9, 95% CI 1.27–6.62) and non-facility-based delivery (OR 3.5, 95% CI 1.47–8.33). [Table 6]

Table 6
Maternal risk factors associated with congenital anomalies

Risk factor	OR	95% CI	p value
Maternal age > 35 years	2.3	1.14–4.63	0.02
No periconceptional folic acid	2.9	1.27–6.62	0.01
Non-facility-based delivery	3.5	1.47–8.33	< 0.01

4 Discussion

This three-year review demonstrates that congenital anomalies requiring paediatric surgical management constitute a substantial proportion of NICU admissions at GARH and are associated with considerable mortality [8–10, 11–14]. The observed prevalence of 1.3% is lower than pooled African estimates but aligns with Ghanaian hospital-based studies reporting a significant surgical burden from congenital anomalies [8–10, 11–14].

Gastrointestinal anomalies predominated, with Hirschsprung's disease, abdominal wall defects and anorectal malformations accounting for most cases.

This pattern mirrors reports from other sub-Saharan African Paediatric surgical units and underscores the central role of Paediatric surgeons in managing life-threatening neonatal conditions [8–10]. The proportion of associated congenital heart disease (5 patients had a CHD associated with other anomalies) highlights the need for multidisciplinary care and contributes to the observed mortality. [11–14]

The overall mortality rate of 19.2%, although lower than that reported in some Ghanaian centers, remains unacceptably high. Contributing factors likely include late presentation, prematurity, sepsis and limited neonatal intensive care resources Prematurity with respiratory distress syndrome was common amongst our cases and with the limited number of ventilators and stress of surgery mortality was high in this group.

All the cases of gastroschisis died during the period mainly from malnutrition and sepsis usually by day 5 of admission. The bowel remained matted and thickened and were thus unable to feed. This is high compared to a rate of 32–47% mortality in a study done in Tamale where surgery was offered to all cases.

Three cases of esophageal atresia were lost after surgery on account of aspiration pneumonia (present preoperatively) and poor respiratory effort. One case had an associated congenital heart disease.

Two cases of jejunal atresia were lost after surgery as most of the small bowel had been resected and no options were available for feeding except for enteral feeds which was not tolerated by the babies. One other case died before surgery could be done since they presented late to GARH.

There was 1 case of meconium peritonitis who presented on day 3 of life and died postoperatively (POD2).

A preterm neonate who had severe renal impairment (serum creatinine of 500umol/l) secondary to posterior urethral valves died after about 2 weeks of care.

[Table 8]

Table 8
Breakdown of causes of death

Cause of death	**Total**
Prematurity/low birthweight with respiratory distress syndrome (RDS)	3
Sepsis and malnutrition secondary to Gastroschisis	5
Respiratory failure secondary to aspiration pneumonia in oesophageal atresia patients	3
Post surgery short bowel syndrome (jejunal atresia cases)	3
Multiple anomalies (ARM with aneuploidy, OA with CHD, OA with duodenal atresia and IUGR)	4
Meconium peritonitis	1
Severe renal impairment in a case of PUV	1

Summary of factors that contributed to the high mortality rate include:

a. late referral to our hospital of cases delivered in other facilities leading to onset of complications before the cases are managed.

b. sepsis and malnutrition in patients who cannot start enteral feeds early such as in cases of gastroschisis and atresia’s due to unavailability of a proper set up for parenteral nutrition. Intravenous amino acids are available for use but is unable to prevent malnutrition from setting in as seen in my

practice in the long term. Lipids and proteins available for parenteral nutrition come in big packages and becomes wasted when opened for use in a neonate. There is also a lack of central IV access (internal jugular/subclavian/femoral) for the neonates and thus affects effective long-term medication and nutrition delivery. Umbilical catheterization / cutdowns using size 6–8 feeding tubes is used initially but tends not to last for more than a week.

c. inadequate ventilatory support for babies requiring it postoperatively due to limited number of ventilators available at the NICU (10 functioning ventilators and 11 bubble CPAP apparatus are available to serve a NICU that admits 56 cases). Cases that will benefit from postop ventilation have to be extubated immediately after surgery and this leads to respiratory failure.

d. lack of renal replacement therapy for neonates in my institution and other major centers. Apart from urethral catheterization, vesicostomy and ureterostomies are the only options to relieve upper tract obstruction and in the long-term the renal impairment.

Importantly, several identified maternal risk factors are potentially modifiable. Lack of periconceptional folic acid supplementation was strongly associated with congenital anomalies in this cohort and in regional meta-analyses [15–18]. Advanced maternal age and non-facility-based delivery further reflect broader sociodemographic and health-system challenges [17–19].

From a clinical perspective, these findings provide actionable data for surgical workforce planning, NICU capacity development and referral pathway strengthening. The NICU at GARH has a 56-bed capacity and admits neonates up to age 1 week only. It has 5 cubicles of which 2 are equipped to handle babies requiring mechanical ventilation. The other rooms are assigned to more stable babies being managed for other medical conditions. There is no designated pediatric surgical intensive care unit and that makes nursing care and monitoring challenging.

From a public health standpoint, they support policies promoting periconceptional folic acid supplementation, early antenatal screening and skilled facility-based delivery [15–18].

5 Strengths and limitations

5.1 Strengths

This study provides detailed, clinically relevant data from a high-volume regional referral center, reflecting the real-world Paediatric surgical workload in an urban West African setting. By focusing on anomalies requiring operative management, the findings directly inform surgical service planning and neonatal intensive care resource allocation.

5.2 Limitations

The retrospective design is subject to incomplete documentation, although records with substantial missing data were excluded. As a single-centre hospital-based study, the findings may not be

generalizable to the wider population, and true population incidence could not be determined.

6 Conclusion

Congenital anomalies requiring Paediatric surgical management at GARH are predominantly gastrointestinal and remain associated with significant neonatal mortality. Addressing modifiable maternal risk factors, improving antenatal detection and strengthening Paediatric surgical and neonatal intensive care capacity are essential to reducing preventable deaths and disability in Ghana.

Declarations

7.1 Ethics approval

Ethical approval was obtained from the Greater Accra Regional Hospital Institutional Review Board. The requirement for individual informed consent was waived due to the retrospective nature of the study and use of anonymized data.

7.2 Funding

No external funding was received.

7.3 Competing interests

The authors declare no competing interests.

7.4 Author contributions

A.N.E.O. conceived the study; D.N.L. and N.A.C. collected data; all authors analysed data, drafted and approved the final manuscript.

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Figures

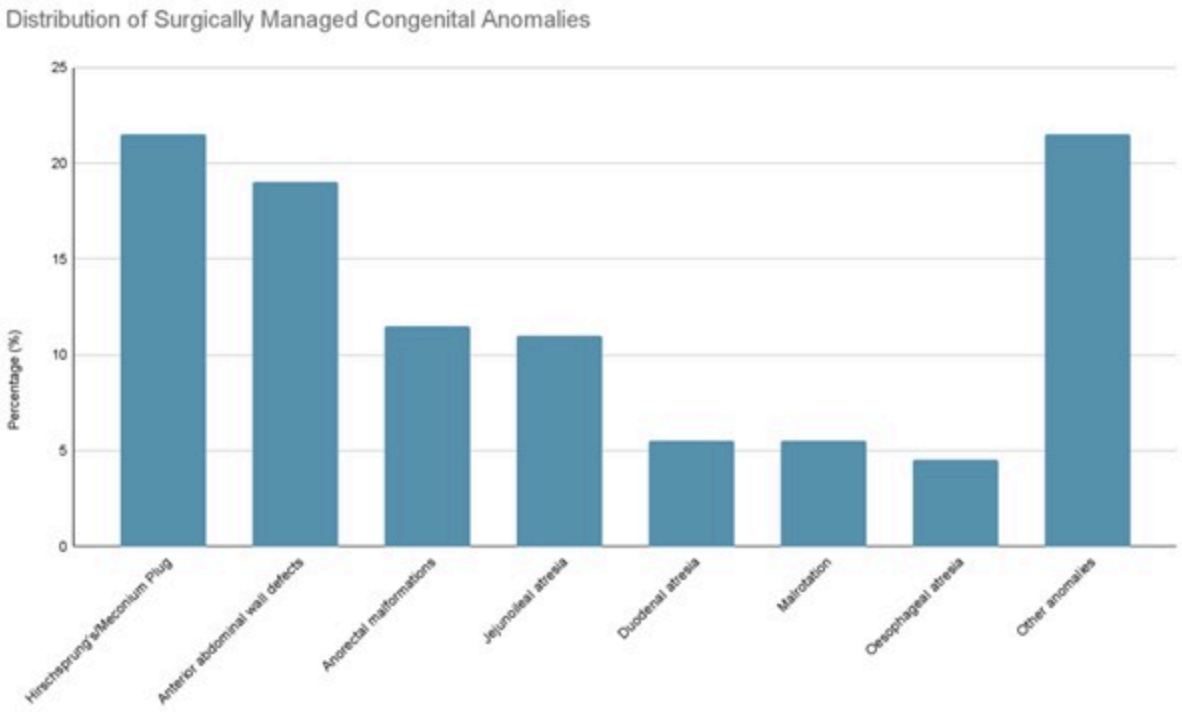


Figure 1

Distribution of Surgically Managed Congenital Anomalies.

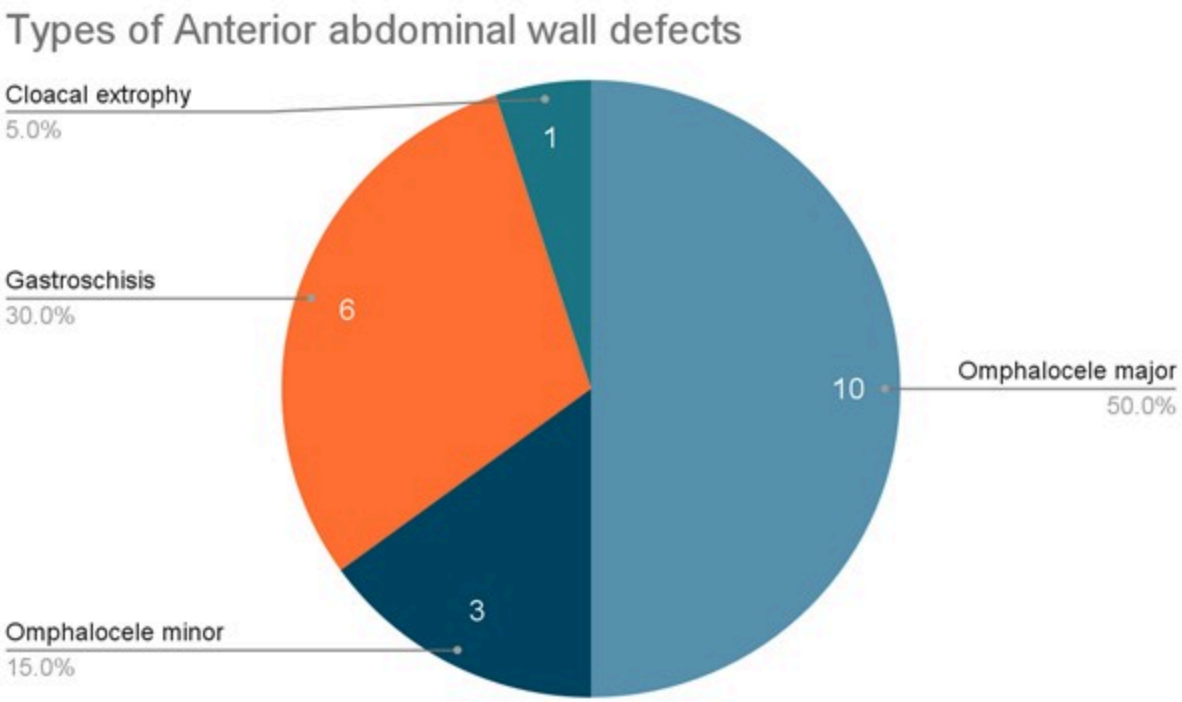


Figure 2

Types of Anterior abdominal Wall Defects

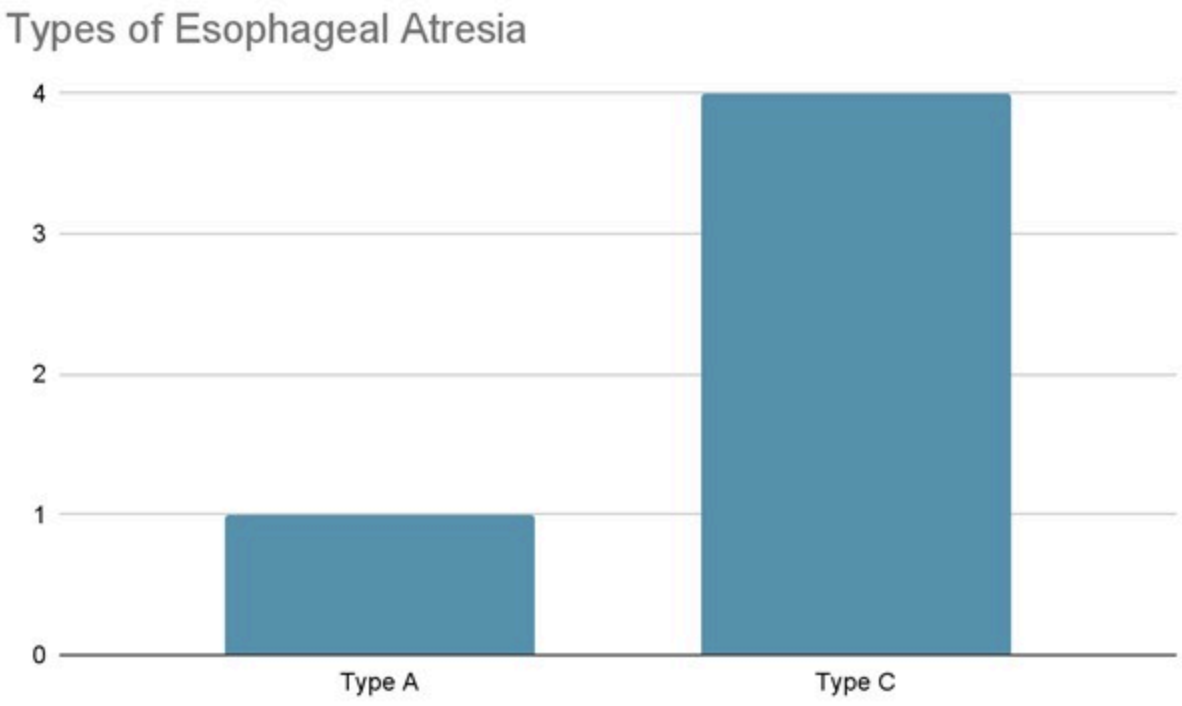


Figure 3

Types of Esophageal Atresia

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