

Esophageal Atresia Management Issues in Senegal: Mortality is Still High

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ABSTRACT

Background: Likewise sub-Saharan african countries, in Senegal the mortality rate related to esophageal atresia is very high despite the efforts directed to neonatal mortality reduction policies. Diamniadio Children's Hospital is a new structure where these cases are taken care. The purpose of this study is to assess the peri-operative management in a new children's hospital.

Patients and Methods: An analytical backward study was conducted from January 2016 to July 2019 at Diamniadio Children's Hospital. We included all neonates undergoing esophageal atresia admitted in the neonatology ward. They were followed up until their discharge.

Results: Overall, 20 patients were collected during the study period. Two neonates passed away before surgery. The mean age was at 5days [1-30] with an average weigh of 2270kg. A notion of inbreeding was outlined in 11 patients. Maternal mean age was at 25years old. Nineteen newborns were sent by different hospitals and health center maternities and were carried by non-medical ambulance. The diagnostic was set up according to the clinical signs, which none of them were systematically revealed. Type III was present in 90% of cases. The majority was represented by Stage B of Waterston accounting for 65%. Ventilation was not performed for any patient before surgery. The operative time-limit was at $5,44 \pm 6,28$ with extremes range from 1 to 30 days. All patients underwent a general anesthesia with an intubation for a right-sided thoracotomy. The majority of the operated patients standing for 61,1% were extubated at he recovery room 2hours after intervention. Hospital infections accounted for 55,5% of the complications and were caused by multiresistant germs. Out of 18 operated patients, 4 have died standing for a mortality rate of 77,7%. Death mostly occurred in the 5th post-surgical day.

Conclusion: The outcome of esophageal atresia is still worsened by hospital infections et the management delay, in our country.

Keywords

Esophageal atresia, Developing country, Mortality.

Introduction

Esophageal atresia is a rare neonatal surgical condition occurring at a rate of 2.4 (1.3-4.6) per 100,000 births [1]. Over the last eighty years mortality has dropped from 100% to 9% in countries with high medical facilities [2]. This mortality rate regression is related to the development of surgical expertise, medical equipment, advances in anaesthesia and neonatology. In Senegal, during these two decades, the mortality rate slightly decreased: from almost 100%

to 73% [3]. This high mortality rate is observed almost everywhere in developing countries, particularly in sub-Saharan Africa [4]. In our country, two recent retrospective surveys conducted in the two Dakar hospitals, which are the only ones authorised to manage these patients, have highlighted the main factors related to this mortality, mainly delayed diagnosis and neonatal infection [3,5]. The Children's Hospital of Diamniadio is a new structure in charge of these types of patients with a perioperative approach mainly focused on neonatology. The purpose of this paperwork is to assess this perioperative management approach in order to identify good outcome factors.

Patients and Method

A retrospective, monocentric, analytical study was conducted at the Diamniadio National Children's Hospital (DCH) over a 30-month period range from January 2016 to July 2019. We included all newborns admitted for esophageal atresia in the neonatology department. Patients with a history of atresia received for dilatation or other complications requiring surgery were excluded. Newborns were followed until they were discharged to home.

The data collection was based on the neonatology medical record and the anaesthetist chart. The parameters studied were as follows:

- Epidemiological: age, sex, origin, time of consultation, history,
- Diagnosis: reasons for consultation, clinical signs, biological findings, type of atresia, malformative assessment, associated pathologies, prognostic classification,
- Therapeutic and evolutionary: time of the surgery, Pre-operative preparation, antibioprophyllaxis, type of anaesthesia, intraoperative incidents, surgical approach, surgical technique, lenght of the surgery, extubation, analgesia and evolution.

Statistical analysis

After entering the data in Excel 2016, EPI info software version 7 was used for data analysis. Qualitative variables are expressed as a percentage or absolute value, quantitative variables as mean and standard deviation. A univariate analysis is performed to identify factors related to hospital mortality.

Results

Overall 20 patients were gathered over the study period, two newborns died before surgery. Table 1 below illustrates the social-demographic and medical parameters.

Table 1: Clinico-demographic characteristics.

Age (day)	5 [1-30]	
Gender M/F	11/9	
Weight (g)	2270,5 [1000-3200]	
Origin (%)	Dakar	30
	Outside Dakar	65
Diagnostic aspects	Chest X-ray with probe (%)	95%
Diagnostic time	OA type (n) I/III/IV	1/18/1
Waterston classification (n)	Class A/B/C	1/13/6
Preoperative ventilation (n)		0
Anaesthesia (n)	GA	20
	RA	0
	Incidents (n)	0
	Hypotension	6
	Bradycardia	2
	Postoperative ventilation	0
Surgical Procedure	Operating time (day)	5,4 [1-30]
	Right Thoracotomy (%)	100
	Operating time (min)	91,94 (± 34,18)

The average age of the mothers was 25 with extremes range from 18 to 37. Inbreeding notion was reported in 11 cases without specifying the degree and 80% of the babies were born at term (Table 2).

Table 2: Characteristics of Perinatal History.

History	Amount	Percentage %	
Amount of antenatal care performed by mothers	0	3	15
	1	1	5
	2	1	5
	3 à 4	13	65
	Non-specified	2	10
Consanguinity	Yes	11	55
	No	7	35
	Non-specified	2	10
Parity	Multipare	13	65
	Primipare	7	35
Number of ante-natal US	0	5	25
	1	8	40
	2	5	25
	hydramnios	3	
Gestational age	Born at term	16	80
	Premature	3	15
	Non-specified	1	5

At the clinical approach, all cases were diagnosed at birth with clinical signs. No cases of routine screening were noted. Digestive and respiratory signs were present in 95% and 85% of patients respectively.

Table 3: Patient Distribution by Clinical Signs.

Clinic	Number	Percentage (%)	
Digestive Signs	Yes	19	95
	No	1	5
Respiratory signs	Yes	17	85
	No	3	15
Other clinical signs	Yes	10	50
	No	10	50

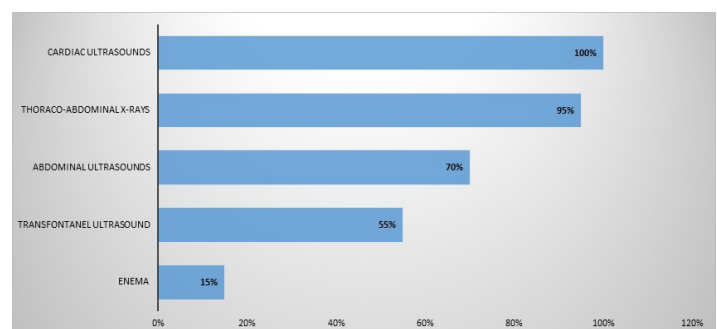


Figure 1: Distribution of patients according to malformative assessment.

Looking for associated malformations, only cardiac ultrasound was systematically performed before the operation.

Among the associated malformations, cardiac malformation was outlined in 8 patients followed by abdominal malformation in 7 patients. Table 4 shows the various associated malformations.

Table 4: Frequency of Associated Malformations.

Associated deformities		Number	Percentage
Heart defect	Yes	8	40
	No	12	60
Abdominal malformation	Yes	7	35
	No	9	45
	Unspecified	4	20
Cerebral Malformation	Yes	2	10
	No	12	60
	Unspecified	5	25
Dysmorphia	Yes	3	15
	No	15	85

Progressively, various complications were noted, as shown in Figure 2.

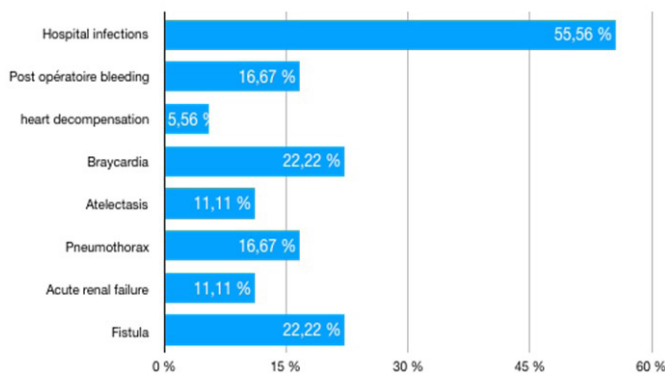


Figure 2: Distribution of postoperative complications.

Hospital infections accounted for more than half (55.5%) of postoperative complications. Multi-resistant germs were isolated from six patients: Citrobacter, Enterobacter spp, Candida spp, Escherichia coli, Staphilococcus Aureus, Klebsiella pneumoniae. Two patients improved under Imipenem and amikacin.

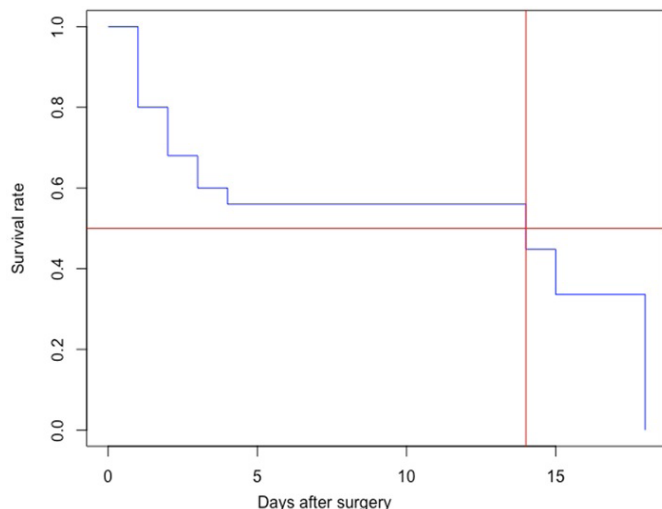


Figure 3: Kaplan-meier curve of postoperative survival of patients.

In this cohort, dietary recovery was effective in 44.4% of patients. Fourteen postoperative deaths, corresponding 77.7%, were recorded and two died before the operation, accounting for 80% of total mortality.

The overall survival curve according to the kaplan-meir method is shown in Figure 3.

Discussion

The results of this retrospective survey conducted in a new hospital in charge of these newborns suffering from esophageal atresia clearly demonstrates the predominant role of infection in high mortality rate. Thus this study confirms in terms of mortality the recent previous work of Fall and Ndoeye with rates higher than 70% [3,5]. This very high mortality rate of over 70% contrasts with that of industrialized countries, which is less than 10% [2].

A data analysis from studies with a better survival rate revealed several factors associated with this perioperative lethality, taking into account the Waterson and Spitz prognostic classifications [6,7]. Lack of antenatal diagnosis, lack of routine probe test at birth, lack of clinical criteria for screening in delivery rooms, lack of resources, and severe infection were the main specific factors related to mortality. These factors have been reported in most studies in developing countries with a direct link to mortality [8-10].

In addition to these factors related to this mortality, we find phenomena known to affect the prognosis of these fragile babies, namely poor neonatal transfer conditions and the absence of in utero transfer. Since in utero transfer could not be performed due to the absence of a maternity ward at the Children's Hospital of Diamniadio, in our study no patient benefited from a medicalized transfer or a transfer performed in compliance with the conditions of neonatal transfer. Transfers were carried out by the district ambulance even for distances over 200km. This problem of neonatal transfer is found in low-income countries where the transfer is carried out without oxygenation and with respect for thermal equilibrium [8,9].

Surgical management of esophageal atresia should be performed as soon as possible after stabilization of the patient and careful evaluation of potential comorbidities [11]. This process requires a lot of resources, including the timely availability of diagnostic tools and qualified personnel. In Senegal, these types of patients are only managed in Dakar, which sometimes explains the long care delays.

Moreover, this surgical management time was also extended by the assessment of the associated malformations. Indeed, once the diagnosis had been established, the search for VARCTERL or VACTER malformations was not readily available, access to echocardiography being the main bottleneck. We had not noted any antenatal suspicion of this condition despite the effectiveness of

obstetrical ultrasound and the notion of hydramnios found in three parturients. This observation raises the issue of antenatal diagnosis in our context where we note a lack of expertise in this field. In their work Ndoye and Fall have strongly attributed mortality to delayed diagnosis and lack of antenatal diagnosis [3,5]. These shortcomings in our policy of reducing neonatal mortality through perinatal networks should be reviewed.

About the anesthetic approach, all patients underwent a general anaesthesia maintained by isoflurane for a better haemodynamic profile to avoid cardiosuppressive halothane in the absence of unavailable sevoflurane. No major life-threatening intraoperative incidents have been reported. However, the thermal protection measures were insufficient, limited only to turning off the air conditioner in the operating room and covering the head with a cap. Neonatal anesthesia requires thermal protection to prevent from hypothermia, which is responsible for several factors that are deleterious to the newborn, including cardiac rhythm and conduction disorders, metabolic acidosis, and decreased immune defence mechanisms [12].

These events can't be hidden in our study as they were not found, they were not sought after. The operating conditions of the newborn should be thermally neutral using heat exchange systems such as forced-air heaters, neonatal operating tables with heated ramps and heated infusion devices. The fate of babies operated on for esophageal atresia by thoracotomy largely depends on this, especially since these patients are at high risk infection due to their immature immune status [13].

Our study also found that postoperative management in the neonatal setting did not improve survival. Despite recommendations on the optimal site of management in tertiary neonatology settings [11]. Mortality was slightly higher 77.7% in neonatal settings or involving pediatric neonatologists versus 73.4% in pediatric surgical resuscitation settings or involving pediatric anesthesiologists in the studies reported by Ndoye and Fall [3,5]. Indeed, this higher neonatal mortality among neonatologists could be explained by a new experience in the management of children undergoing surgery. The perioperative management of operated children was exclusively reserved for anaesthetists and surgeons in our country. Thus, multidisciplinary management including obstetricians, anaesthetists, neonatologists and surgeons performing a concerted management protocol would improve prognosis.

Surgery for esophageal atresia is a surgical digestive emergency where early feeding plays an important role [8,11]. Feeding the newborn is fundamental in that it allows good weight growth and strengthens defence functions against aggression [14]. In the case of esophageal atresia, this food intake will be done as soon as possible either by enteral nutrition through a feeding tube or by parenteral nutrition to support enteral feeding in case of tracheo-esophageal fistula. In our study the unavailability of parenteral solutions for newborns was one of the major obstacles in treatment after surgery. The delay in food intake was particularly long, justified by the impossibility of starting a parenteral nutritional

solution adapted to the patient. To increase survival we will also have to seek these food resources and put them into a care program despite their unavailability and high cost to our patients.

Our study has a number of weaknesses related to the retrospective nature, the relatively small number of patients and the lack of precise data on the conditions of transfer of the babies and the real impact of the transfer in the perioperative prognosis. However, the strength of this study lies in the uniformity of therapeutic procedures involving the same neonatologists and anaesthetists. All surgeries were performed by a single surgeon.

Conclusion

Survival of children born with esophageal atresia remains very low despite an improved prognosis over the past decade in our country. The mortality of these newborns continues to be a factor in Senegal's neonatal mortality score of 19/oo [HDS 2019]. The need for a multidisciplinary approach involving all the partners and authors of perinatal care is paramount to save these children who hardly ever die of this condition under other skies.

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