



## **How can we improve perinatal care in isolated multiple intestinal atresia? A retrospective study with a 30-year literature review**

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**How can we improve our perinatal care in isolated multiple intestinal atresia? A retrospective study with a thirty-year literature review.**

N. Vinit<sup>a</sup>, D. Mitanchez<sup>b,f</sup>, J. Lemale<sup>c</sup>, C. Garel<sup>d</sup>, J.-M. Jouannic<sup>e,f</sup>, E. Hervieux<sup>a</sup>, G. Audry<sup>a,f</sup>, Sabine Irtan<sup>a,f</sup>

<sup>a</sup> *Department of Visceral and Neonatal Pediatric Surgery, Hôpital Armand Trousseau, APHP, 26 avenue du Dr Arnold Netter, 75012 Paris, France*

<sup>b</sup> *Department of Neonatology, Hôpital Armand Trousseau, APHP, 26 avenue du Dr Arnold Netter, 75012 Paris, France*

<sup>c</sup> *Department of Pediatric Nutrition and Gastroenterology, Hôpital Armand Trousseau, APHP, 26 avenue du Dr Arnold Netter, 75012 Paris, France*

<sup>d</sup> *Department of Pediatric Radiology, Hôpital Armand Trousseau, APHP, 26 avenue du Dr Arnold Netter, 75012 Paris, France*

<sup>e</sup> *Department of Obstetrics and Fetal Medicine, Hôpital Armand Trousseau, APHP, 26 avenue du Dr Arnold Netter, 75012 Paris, France*

<sup>f</sup> *Sorbonne Université, Paris, France*

Corresponding author: Prof. Sabine Irtan, Department of Visceral and Neonatal Pediatric Surgery, Hôpital Armand Trousseau, 26 avenue du Dr Arnold Netter, 75012 Paris, France

Email address: [sabine.irtan@aphp.fr](mailto:sabine.irtan@aphp.fr)

Phone: +33(0)1 44 73 65 80, Fax: +33(0)1 44 73 69 79

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## **Abstract**

*Introduction:* Multiple intestinal atresia (MIA) is a rare cause of neonatal intestinal obstruction. In order to give an overview of its current prenatal, surgical and nutritional management, we report our experience and a literature review of papers published after 1990.

*Methods:* All cases of isolated MIA (non-hereditary, not associated with apple-peel syndrome or gastroschisis) treated at our institution between 2005 and 2016 were reviewed and compared to cases found in the literature.

*Results:* Seven patients were prenatally suspected of intestinal obstruction and postnatally diagnosed with MIA, with a mean 1.7 [1-2] resections-anastomoses (RA) and 6 [1-10] stricturoplasties performed, resulting in a mean resected bowel length of 15.1 cm [15-25]. Median time to full oral feed was 46 days [14-626]. All patients were alive and none had orality disorder after a mean follow-up of 3.1 years [0.2-8.1].

Three surgical strategies were found in the review: multiple RA (68%, 34/50) including Santulli's technique in 4/34 (12%) and anastomoses over a transanastomotic tube (32%, 16/50), with a 98% survival rate and short-bowel syndrome for only two patients.

*Conclusions:* Bowel-sparing surgery and appropriate medical management are key to ensure a favorable nutritional, gastrointestinal and vital prognosis. Prenatal assessment and standardizing the surgical course of treatment remain challenging.

**Key-words:** Multiple intestinal atresia, Neonatal surgery, Intestinal obstruction, Prenatal diagnosis, Orality disorders

## **1. Introduction**

Multiple intestinal atresia (MIA) accounts for 6 to 32% of intestinal atresia in the newborn [1–3] and is a rather uncommon cause of neonatal intestinal obstruction with a prevalence of 1/5000 live births [4].

Preserving bowel length is the main surgical challenge, in order to achieve full oral feed. Despite the significant improvements in the medical and surgical care of these children, many challenges remain such as prenatal detection and the lack of a standardized surgical course of treatment. In order to give an overview of the prenatal and postnatal management of these children, we report our own experience and carry out a literature review.

## **2. Materials and methods**

All included patients had primary MIA treated in our center between May 2005 and December 2016. Patients were operated on by four experienced surgeons in our department, two of whom treated several patients (2 and 3, respectively). MIA was defined as having at least two intestinal atresias, from the jejunum down to the rectum. In order to study the specific characteristics of MIA and its consequences on the small bowel function, patients with associated gastroschisis, duodenal atresia, apple-peel syndrome or hereditary MIA were excluded.

To define the type of atresia, the modified Grosfeld classification of intestinal atresias [5] was used, in which we chose to include primary intestinal stenosis as type 1 atresia (*Figure 1*).

Data collected included: prenatal management and birth, surgical treatment, nutritional support and clinical follow-up by a senior pediatric surgeon or gastroenterologist. Pathology reports from the resected bowel were reviewed.

In order to compare our results with the literature, we searched the PUBMED database using “multiple intestinal atresia” and retrieved all English-written cohort studies and/or literature reviews published after the 1990s where surgical treatment and outcome were specified.

### **3. Results**

From 2005 to 2016, eight patients with MIA were treated at our institution. One had MIA with apple-peel syndrome and therefore was excluded from the analysis. None had MIA with duodenal atresia, hereditary MIA or gastroschisis-associated MIA.

#### ***3.1. Prenatal management***

Intestinal obstruction was diagnosed prenatally on routine bidimensional ultrasound in every case at a mean gestational age of 25.2 weeks of pregnancy [16.2-32 weeks]. Sonographic diagnosis was based on the following features: persistent bowel loop dilatation (7/7, 100%), polyhydramnios (3/7, 43%), intraperitoneal calcifications (3/7, 43%), hyperechoic bowel (2/7, 29%) and ascites (2/7, 29%). Intrauterine growth retardation (IUGR) was observed in 4 out of 7 cases (57%). Amniocentesis was performed in 6 cases (one mother refused amniotic fluid puncture) and showed normal karyotype with elevated digestive enzymes suggestive of bilious emesis. Although postnatal screening was negative for every newborn, cystic fibrosis was prenatally ruled out in only 2 cases. In 3 cases, a prenatal MRI was performed at 30.5 weeks [29.5-32.3 weeks] confirming dilated bowels loops, suggestive of a proximal atresia, and revealing a microcolon on T1-weighted sequences. The length of the small bowel could not be estimated because bowel distal to the atresia could not be seen clearly. Amniotic drainage was necessary in only one case.

Delivery occurred at an average 34.1 weeks [31.1-37 weeks] with a mean birth weight of 2143g [1500-2760 g].

### ***3.2. Surgical management***

All patients presented with signs of intestinal obstruction at birth. Postnatal associated congenital anomalies included bilateral syndactyly between the second and third digits for one patient and an inner ear hypoplasia for another, for which no mutation was found in CHD7 or SOX10.

Surgery was performed in the first two days of life for all patients. Surgical findings and courses of treatment are presented in *Table 1*.

A total of 34 intestinal atresias were found intraoperatively (median per patient = 3 [2-14]): jejunal in 68% (n = 23), ileal in 29% (n = 10) and colonic in 3% (n = 1). Atresias were type I (diaphragm or stenosis) in 74% (n = 25), type II in 6% (n = 2) and type IIIA in 21% (n = 7). One case of intestinal malposition was diagnosed at birth using a barium enema and confirmed intraoperatively.

The mean number of surgical procedures was 2 per patient [1-6]. On the primary surgical procedure, multiple resections and anastomoses (RA) were performed for every patient but one, for whom a proximal jejunostomy was made in place of a type I atresia (patient 7). Another patient had a jejunal stoma, protecting multiple RA (patient 6).

Three patients had a secondary procedure: one had an undiagnosed sigmoid diaphragm resected; one had an atretic segment resection along with stoma closure. The last one had 14 atresias (patient 7), one RA was performed on an atretic segment as well as 8 stricturoplasties on type-I atresias. Another RA and another stricturoplasty was then performed on the same patient after a postoperative peritonitis due to bowel perforation proximal to a missed type-I ileal atresia. A final stricturoplasty was performed at stoma closure allowing ileocecal valve

preservation. Tapering on the proximal end was needed in two cases. Mean resected bowel length was 15.1 cm [5-25 cm]. Ileocecal valve was preserved in every case. There was no short-bowel syndrome.

There were no postoperative complications such as anastomotic leak or stenosis.

### ***3.3. Nutritional support***

Parenteral nutrition (PN) was started on central line catheter immediately after the first surgical procedure. Median duration of PN was 39 days [14-402 days]. The 5 patients with primary RA were weaned off PN after 32 days [14-46 days] while the two patients (patients 6 and 7 in *Table 1*) with a stoma were weaned off PN after 87 and 402 days respectively. Intestinal epithelial growth was stimulated through minimal enteral feeding (MEF) in 71% of cases (5/7). Median duration of MEF was 8 days [3-16 days]. MEF was started from a median 11 days [5-16 days] after surgery and gradually increased according to clinical tolerance, until reaching 24 mL/kg/day of breast milk.

All patients but one had enteral nutrition with constant flow (ENCF), started from a median 22 days [14-367 days] after surgery, with a median duration of 13 days [6-259 days]. The last one (patient 1 in *Table 1*) was bottle fed right after MEF.

For one patient (patient 7), a gastrostomy had to be placed due to bad tolerance of the feeding tube. Fifty-seven percent of the newborns (4/7) developed septic complications due to central line catheter infection and only one had transient cholestasis.

Although none of the pathology reports showed congenital aganglionosis, patient 7 presented with transitory intestinal dysmotility and was therefore dependent on PN for the longest.

The median hospital stay for the initial hospitalization was 59 days [34-232 days]. At the end of the first hospitalization, 57% (4/7) of the patients had acquired full oral feed. The remaining three were still dependent on PN (1/7) or enteral nutrition (1/7) or both (1/7).

### **3.4. Follow-up**

At a median follow-up of 2.4 years [0.2-8.1 years], all patients were alive. The median time to acquisition of full oral feed was 46 days [14-626 days]. All patients benefitted from oral sphere stimulation during their hospital stay.

At one-year follow-up, 71% (5/7) had acquired full oral feed and 29% (2/7) still had both emesis and orality disorders. Only one patient (Patient 7 in *Table 1*) had severe orality disorder, probably worsened by eosinophilic esophagitis, requiring intensive orthophony and psychomotor rehabilitation. He was kept off oral feed for 141 days total, while the median duration of oral feed exclusion was 31 days [6-55 days] for all the others. The other patient with orality disorder presented with persistent regurgitations in spite of a proper antacid treatment. At last follow-up, every patient had acquired full oral feed and none had remaining emesis or orality disorders. Overall growth was deemed satisfactory for every patient but one (patient 3 in *Table 1*) who had a regular growth under the 3<sup>rd</sup> percentile for height and weight.

### **3.5. Literature review on MIA**

The reviewing process is presented in *Figure 2*. Articles including hereditary MIA were excluded because of the distinct pathogenesis and prognosis. Articles including cases with all types of intestinal atresias, necrotizing enterocolitis or MIA with ‘apple-peel’ were also excluded if data from these cases could not be individualized from that of isolated MIA [6–20]. The four remaining articles were reviewed [4,5,21,22]. The study published by Romao et al [4] included a literature review compiling his data with that of four case reports [1–3,23]. Three cases were excluded: one had a necrotizing enterocolitis, one had MIA with apple peel [2] and the last one had a complex gastroschisis [1]. Similarly, one case of necrotizing enterocolitis and one of complex gastroschisis was excluded from the study of Sapin et al [21]



and five cases (2 MIA with apple peel, 3 complex gastroschisis) were excluded from that of Baglaj et al [22]. Our review included only 12 cases with MIA out of the 43 patients with intestinal atresia reported in the study of Calisti et al [5]. Thus, fifty cases (including our cohort) of isolated MIA were reviewed (*Table 2*), with a global prevalence of 16% of primary MIA among published intestinal atresias, excluding the very rare MIA with apple-peel and MIA associated with abdominal wall defects.

The only study to mention prenatal detection of MIA was that of Baglaj et al [22], in which an intestinal anomaly was suspected on prenatal ultrasound (dilated hyperechoic bowel loops) in 9 cases (43%). Although polyhydramnios was present in 6 cases (29%), MIA was never considered prenatally in any patients, according to the authors. No fetal MRI was performed. Surgical management included RA with stoma (20%, 10/50), RA without stoma (48%, 24/50) or anastomosis over a transanastomotic tube (TAT) (32%, 16/50) with a stoma in 5/16 cases (31%). When a stoma was used, Santulli's technique [24] was performed in 27% of cases, (4/15). Regardless of the surgical strategy, 30% of patients (15/50) had a stoma and needed from 1 to 3 procedures. Tapering was used in 41% of cases. Twenty-three percent (10/43) of patients suffered from postoperative complications. Anastomotic leak (31%), undiagnosed atresias (23%) and adhesive obstruction (23%) were the most frequent. Although anastomotic stricture was less common, its occurrence was not prevented by the use of a TAT. There were no complications following the use of Santulli's technique. Only 2 patients had short bowel syndrome (5%), one of whom had to undergo a bowel lengthening procedure and was the only one still dependent on PN. The survival rate was 98%. The only death was imputable to septic complications. In this literature review, no data was found regarding orality disorders during follow-up.

#### **4. Discussion**

Although prenatal detection and the determination of the best surgical course of treatment are still challenging, isolated MIA seems to be associated with overall favorable gastrointestinal, nutritional and vital prognoses.

With advances in fetal imaging and amniotic fluid analyses, prenatal diagnosis of small-bowel atresia has been made possible [25,26]. Ultrasound features are not specific of a cause of obstruction (persistent dilated bowel loops, hyperechoic bowel, signs of meconium peritonitis) but the presence of a polyhydramnios suggests a proximal (up to the jejunum) blockage. Prenatal MRI may be of interest for confirming the small-bowel atresia (length of dilated bowel loops, microcolon with decreased T1 meconium signal) and determining the level of obstruction (signal intensity changes in the dilated loops linked to the level of the obstacle), but no specific signs enable accurate evaluation of the small-bowel length [27]. Giving the scarcity of the literature on this issue, the reliability of fetal MRI in evaluating small-bowel length, determining apple peel patterns or distinguishing multiple atretic segments still needs improvement [28]. Thus, with the current lack of specificity of prenatal diagnosis in small-bowel atresia, the 20-percent risk of MIA at diagnosis should be taken into consideration by the pediatric surgeon when giving prenatal counseling. Although the overall long-term prognosis seems reassuring (high survival and full-oral-feed achievement rates), delivered information should include the risk of repeat surgical procedures and prolonged parenteral nutrition. We would also argue for fetal MRI being performed in every case of suspected intestinal atresia in order to improve our assessment of the small-bowel length.

One of the other challenges in MIA is determining the best surgical course of treatment. Although the basic principles of preserving bowel length and tackling the dysmotility of the proximal end are unanimous [1,5,21], no study has been able to determine the best surgical technique. In our study, we favored stricturoplasties in cases of type-1 atresia and multiple

RA in other types. Few descriptions of the use of stricturoplasties in intestinal atresia are found in the literature [22] when it appears to be a safe technique to avoid unnecessary intestinal resection. These approaches allowed for a quick full-oral-feed achievement and avoided short-bowel syndrome. The use of a stoma is debated. When using a TAT, Romao et al [4] suggest that an enterostomy may reduce the risk of anastomotic leak, but it bears the risk of stoma morbidity and requires a second procedure. The same considerations exist in multiple RA, but available data does not allow to determine the number of RA that should lead to performing a stoma. Intestinal derivation can either be complete or partial, using Santulli's technique [24], consisting in an end-to-side anastomosis of the distal end onto the proximal one. The latter is then used as an enterostomy. Santulli's technique allows for both the decompression of the proximal end and the progressive feeding instillation of the distal one, adapted to its functional capacity. Strengths and limitations of each technique are presented in *Table 3*.

The two main postoperative complications are anastomotic leak, which may be linked to the poor nutritional status at birth [29], and missed atresias. We then wish to insist on the importance of a thorough first exploration using gentle instillation of warm saline. Reducing the number of missed atresia is probably something surgeons can act on to improve these newborns' outcome.

Unlike surgical techniques, neonatal care and nutritional management have greatly improved over the years, significantly affecting the outcome of newborns with MIA. A multidisciplinary approach is crucial as there are particularly at risk for medical complications and orality disorders, which leads to prolonged parental nutrition and its complications. Among the studies reviewed, none mentioned orality disorders in the follow-up whereas it affected up to 29% (2/7) of our patients and required intensive psychomotor care. The study of Michaud et al [30] is one of the few to describe potential factors affecting orality after

gastrointestinal surgery in newborns, including the time without any oral feed, the painful stimulation of the oropharyngeal sphere, the presence of a gastric tube and whether oral feed was possible before surgery. In our study, the two patients who developed orality disorders kept a gastric tube and were kept off oral feed for the longest (141 and 55 days). Oral stimulation therefore seems an important aspect of the neonatal care and should be part of the neonatal management of MIA. **Orality disorders eventually regressed in the first three years of life.** An algorithm for the management of MIA is represented in *Figure 3*.

Despite the lack of power of this retrospective study, our literature review is the largest one published on isolated MIA, thus adding to their objective evaluation. Because of their specific issues, MIA should not be reported among all types of atresia but as a distinct entity.

## **5. Conclusion**

With a prevalence of 16% amongst intestinal atresia, MIA is a rather rare cause of neonatal intestinal obstruction. Our data suggest that multiple RA and the use of stricturoplasties are a safe way to avoid short-bowel syndrome. **Oral stimulation and early oral feed should be attempted whenever possible in order to decrease the risk of orality disorder and prolonged artificial nutrition.** Although advances in the medical management have led to an overall favorable prognosis when isolated, challenges remain regarding prenatal diagnosis, thus impacting parents' counseling and medical anticipation of the malformation.

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## Tables and Figures Captions

**Figure 1.** Modified Grosfeld classification of intestinal atresia including intestinal stenosis.

Type I: Primary intestinal stenosis or intraluminal diaphragm, Type II: Atretic ends connected by a fibrous cord (intact mesentery), Type IIIA: Atretic ends separated by a mesenteric defect, Type IIIB: ‘Apple-peel’ atresia, Type IV: Multiple intestinal atresia.

**Figure 2.** Flow-chart for the systematic review process. Four cohort studies with isolated MIA were found and reviewed [4,5,21,22]

\*2 studies had patients’ overlap in recruitment [18,19]

\*\* 3 cases of MIA with apple peel and 5 cases of complex gastroschisis were excluded from three of the studies [4,21,22]

**Table 1.** Surgical findings and management. Stoma closure was not considered as secondary RA

T: Tapering, (+1): Number in brackets indicates number of subsequent procedures

**Table 2.1.** Systematic review with four studies on MIA [4,5,21,22]: prenatal management. Intestinal malposition was not considered as an associated congenital anomaly

**Table 2.2.** Systematic review with four studies on MIA [4,5,21,22]: surgical management

**Table 2.3.** Systematic review with four studies on MIA [4,5,21,22]: Nutritional management

<sup>a</sup>The infant who did not survive died of sepsis

**Table 3.** Strengths and limitations of the three surgical strategies described in the literature review

**Figure 3.** Algorithm suggested for the management of multiple intestinal atresia

MRI: Magnetic Resonance Imaging

**Table 1.** Surgical findings and management. Stoma closure was not considered as secondary RA

Pt	Term (GW)	BW (g)	Intestinal atresia						Surgical management					Nb of surgical procedures	Small bowel length		Surgical complications
			Jejunum		Ileum		Colonic		RA		Stricturoplasty		Stoma		Remaining (cm)	Resected (cm)	
			Type	Nb	Type	Nb	Type	Nb	Primary	Secondary	Primary	Secondary					
1	33.2	1830	I II	1 1					1					1	NS	25	
2	34.5	2300	IIIa	1	I	1			2 (T)					1	119.5	5	
3	32.4	1500	I	3					1					1	NS	10	
4	37	2410	IIIa	1	I	1			1		1			2	99	19	Duodenal adhesive obstruction
5	34.6	2760	I II	3 1			I	1	1	1				2	NS	19	Missed colonic atresia
6	31.1	1830	IIIa	4	I IIIa	1 1			2 (T)	1			+	2	70	18	
7	35.2	2370	I	8	I	6				1 (+1)		8 (+1, +1)	+	6	80	9.5	Peritonitis following ileal perforation above a missed stenosis

T: Tapering, (+1): Number in brackets indicates number of subsequent procedures

Pt: Patient, Nb: number, GW: Gestational weeks, BW: Birth weight, RA: Resection and anastomosis, T: Tapering, (+1): Number in brackets indicates number of subsequent procedures, NS: Not stated.

**Table 2.1.** Systematic review with four studies on MIA [4,5,21,22]: prenatal management. Intestinal malposition was not considered as an associated congenital anomaly

Authors	Inclusion period	Patients with isolated MIA	Gender ratio	Prenatal diagnosis			Birth		
				Yes /No	Prenatal ultrasound	Prenatal MRI	Mean GA (weeks)	Mean birth weight (g)	Associated congenital anomalies
<b>Our series</b>	2005-2016	7	3 F - 4 M	100% (25.2 weeks)	Bowel dilatation 100% (7), IUGR 57% (4), Polyhydramnios 43% (3), Calcifications 43% (3), Ascitis 29% (2), Hyperechoic bowel 29% (2)	43% (3) : bowel dilatation, microcolon	34.1 [31.1-37]	2143 [1500-2760]	29% (2)
<b>Calisti et al [6]</b>	1992-2009	12/43	NR	NR	NR	NR	36.1 [32-41]	NR	8% (1)
<b>Sapin et al [26]</b>	1992-1995	4/6	4 M	NS	NS	NS	34 [33-34.5]	2675 [2400-3000]	NS
<b>Romao et al [5]</b>	NS	6/9	1 F - 5 M	NS	NS	NS	34.3 [33-37]	2328 [1860-3090]	NS
<b>Baglaj et al [27]</b>	1986-2006	21/26	NS	43% (9/21)	Polyhydramnios 29% (6)	NS	NR	NR	NR, one patient had cystic fibrosis

M: Male, F: Female, IUGR: Intrauterine growth retardation, GA: Gestational age, MRI: Magnetic resonance imaging, NS: Not stated, NR: Not retrievable

**Table 2.2.** Systematic review with four studies on MIA [4,5,21,22]: surgical management

Authors	Patients with isolated MIA	Intraoperative assessment				Surgical management										
		Mean number of atresias	Jejunal	Ileal	Colonic	Mean number of surgeries	TAT	Santulli	Stoma	Mean number of RA per patient	Mean number of stricturoplasties per patient	Tapering	Mean resected SBL (cm)	Mean remaining SBL (cm)	SBS	Postoperative complications
<b>Our series</b>	7	5 [2-14]	15 I, 2 II, 6 IIIA	9 I, 0 II, 1 IIIA	1 I	2 [1-6]	0	0	29% (2)	1.7 [1-2]	6 [1-10]	29% (2)	14 [5-25]	92 [70-119.5]	0	43% (3) : adhesive obstruction (1), missed atresia (2)
<b>Calisti et al [6]</b>	12/43	[2-10]	NR	NR	NR	NR	0	0	17% (2)	≤ 3	NA	100%	NR	NR	NR	17% (2) : adhesive obstruction (1), leak (1)
<b>Sapin et al [26]</b>	4/6	7 [5-9]	NS	NS	NS	2	0	100% (4)	100% (4)	6 [4-8]	0	75% (3)	NS	87.2 [54-107]	0	0
<b>Romao et al [5]</b>	6/9	13 + [5-15] webs	NS	NS	NS	1.8 [1-2]	100% (6)	0	50% (3)	NS	NS	NS	NS	64.1 [19.5-106]	25% (1)	stricture or leak (NR)
<b>Baglaj et al [27]</b>	21/26	5 [2-10]	40 I, 15 II, 42 IIIA		0	1.6 [1-3]	48% (10)	0	19% (4)	2 [1-6]	2 [1-5]	14% (3)	NR	NR	5% (1)	24% (5): leak (3), missed atresia (1), stricture (1), adhesive obstruction (1), jejunal volvulus (1), bowel perforation (1)

RA : Resection and anastomosis, TAT: Transanastomotic tube, SBL: Small bowel length, SBS: Short bowel syndrome, NS: Not stated, NR: Not retrievable, NA: Not applicable.

**Table 2.3.** Systematic review with four studies on MIA [4,5,21,22]: Nutritional management

Authors	Patients with isolated MIA	Nutritional support			Mean time to stoma closure (days)	Last follow up				
		Mean duration of PN (days)	MEF	PN complications		Survival rate	Full oral feed achieved	Secondary small bowel lengthening	Orality disorders	Mean follow-up (months)
<b>Our series</b>	7	93 [14-402]	71% (5)	Transient cholestasis (14%), Sepsis (57%)	281 [50-512]	100%	100%	0	0	93.1 [7.2-245.8]
<b>Calisti et al [6]</b>	12/43	36 [7-150]	NS	Sepsis 8% (1)	≤ 120	92% (11) <sup>a</sup>	NR	0	NS	≥ 12 months
<b>Sapin et al [26]</b>	4/6	89 [48-163]	NS	Transient cholestasis (25%)	48 [28-67]	100%	100%	0	NS	34.5 [14-56]
<b>Romao et al [5]</b>	6/9	NR	NS	NS	NS	100%	83% (5)	25% (1): STEP procedure	NS	NR, ≥ 4 months
<b>Baglaj et al [27]</b>	21/26	NR, ≤ 600 days	NS	Cholestasis (5%)	NS	100%	100%	0	NS	NR, ≥ 3 months

<sup>a</sup>The infant who did not survive died of sepsis.

MEF: Minimal enteral feeding, PN: Parenteral nutrition, STEP: Serial transverse enteroplasty, NS: Not stated, NR: Not retrievable. \*The infant who did not survive died of sepsis.

**Table 3.** Strengths and limitations of the three surgical strategies described in the literature review

<b>Surgical strategy</b>	<b>Strengths</b>	<b>Limitations</b>
<b>Multiple RA / stricturoplasties</b>	Possibility of a one-step procedure	Stoma may be needed
	No association between the number of anastomosis and PN duration [27]	
	Low rate of secondary stomas: 20% according to our literature review [6,27]	
<b>TAT</b>	Possibility of a one-step procedure	Insertion of a medical device
	Technically easy: gross sutures allowed	Does not prevent anastomotic leak or strictures [1,5] as advocated
	Lower probability of missed atresias	Stomas may be needed (entry and exit sites)
<b>Santulli's technique</b>	Semi-permissive diversion allowing decompression of the proximal end and gradual nutritive growth	At least 2 procedures
	Use of elective approach for stoma closure	May be less effective in case of very proximal diversion with high-output stoma
	May enable early stoma closure	May be technically demanding (risk of kinking)

RA: Resection and anastomosis, TAT: Transanastomotic tube.