

Analysis of postoperative complications in patients undergoing anorectal malformation surgery: are there any predisposing factors?

A. Hernández Pérez, P. Deltell Collomer, C. Abril Sánchez, A. Encinas Goenechea, J. González Piñera, M. Dore Reyes, I. Martínez Castaño, P. Alcaraz Jiménez, V. Díaz Díaz, M.G. Toro Rodríguez

Pediatric Surgery Department. Hospital General Universitario Dr. Balmis. Alicante (Spain).

ABSTRACT

Objective. To describe our experience with anorectal malformation (ARM) patients, while analyzing complications and risk factors.

Materials and methods. A retrospective study of ARM patients aged 0-18 years old undergoing surgery from 2006 to 2023 was carried out. Demographic variables, associated malformations, age and repair surgery operating times, presence and type of colostomy, previous intestinal preparation, and presence and type of surgical complications –intestinal occlusion, anal prolapse, stenosis, bleeding, dehiscence, extrusion, anoplasty misposition, urethral perforation, and stomal complications– were collected.

Results. 89 patients were studied. 44 patients were boys and 45 were girls. Median age was 7 years (3-18). Baseline treatment was posterior sagittal anorectoplasty (PSARP) in 61 (69%) patients, and colostomy in 24 (27%) patients (4/24 loop, 1/24 Hartmann, 19/24 divided ends). Median age at PSARP was 5.4 months (5 days-7 years), with a mean operating time of 112 min (38-259). The incidence of complications was 38% (34/89). The most frequent complication was anal prolapse (19%) (1/3 reintervention as a result of pain/bleeding), followed by dehiscence (17%). Statistically significant differences were noted between intestinal preparation ($p=0.001$, -1.49 95% CI: -2.69 to -1.24), presence of colostomy ($p=0.05$, -2.54 95% CI: -6.5 to -0.987), and age at surgical repair ($p=0.047$, 1.198 95% CI: 1.1 to 3.15) with the incidence of complications. The age-complications correlation score was 0.21 ($p=0.046$). No differences in terms of operating time ($p=0.073$) and type of colostomy ($p=0.81$) were observed.

Conclusions. 38% of the patients had complications. Intestinal preparation, presence of colostomy, and age at repair can have an impact on the incidence of complications. The first two could stand as protective factors ($RR=-1.49$ and -2.54 , respectively). Age would increase the risk by 1.2-fold.

KEY WORDS: Anorectal malformations; Posterior sagittal anorectoplasty; Morbidity; Colostomy; Cathartics.

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Corresponding author: Dr. Alba Hernández Pérez. Pediatric Surgery Department. Hospital General Universitario Dr. Balmis. Av. Pintor Baeza, 12. 03010 Alicante (Spain).

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ANÁLISIS DE LAS COMPLICACIONES POSTOPERATORIAS EN PACIENTES INTERVENIDOS DE MALFORMACIÓN ANORRECTAL: ¿EXISTEN FACTORES PREDISPONENTES?

RESUMEN

Objetivos. Describir nuestra experiencia con pacientes afectos de malformaciones anorrectales (MAR), analizando complicaciones y factores de riesgo.

Material y métodos. Estudio retrospectivo de pacientes con MAR de 0-18 años (intervenidos entre 2006-2023). Se recogieron variables demográficas, malformaciones asociadas, edad y duración de la cirugía correctora, presencia y tipo de colostomía, preparación intestinal previa, existencia y tipo de complicaciones quirúrgicas: oclusión intestinal, prolapso anal, estenosis, sangrado, dehiscencia, extrusión, malposición de la anoplastia, perforación uretral y complicaciones del estoma.

Resultados. Se obtuvieron 89 pacientes, 44 niños y 45 niñas, mediana de 7 años (3-18). El tratamiento inicial fue la anorrectoplastia sagital posterior (ARPSP) en 61 (69%) y colostomía en 24 (27%) (4/24 asa, 1/24 Hartmann, 19/24 cabos separados). La mediana de edad de ARPSP fue de 5,4 meses (5 días-7 años), con duración quirúrgica media de 112 min (38-259). La incidencia de complicaciones fue del 38% (34/89). La más frecuente fue el prolapso anal (19%) (1/3 reintervención por dolor/sangrado) seguida de la dehiscencia (17%). Observamos diferencias estadísticamente significativas entre la preparación intestinal ($p=0,001$, $-1,49$ IC 95%: $-2,69$ a $-1,24$), existencia de colostomía ($p=0,05$, $-2,54$ IC 95%: $-6,5$ a $-0,987$) y la edad de corrección quirúrgica ($p=0,047$, $1,198$ IC 95%: $1,1-3,15$) con la incidencia de complicaciones. El coeficiente de correlación edad-complicaciones fue de $0,21$ ($p=0,046$). No observamos diferencias con el tiempo quirúrgico ($p=0,073$) y el tipo de colostomía ($p=0,81$).

Conclusiones. El 38% de los pacientes presentó alguna complicación. La preparación intestinal, la existencia de colostomía y la edad de corrección pueden influir sobre la incidencia de complicaciones. Las dos primeras podrían constituir factores protectores ($RR=-1,49$ y $-2,54$ respectivamente). La edad incrementaría el riesgo 1,2 veces.

PALABRAS CLAVE: Malformación anorrectal; Anorrectoplastia sagital posterior; Complicaciones; Colostomía; Preparación intestinal.

INTRODUCTION

Anorectal malformations represent a whole spectrum of congenital diseases with an incidence of 2 cases/10,000 live newborns⁽¹⁾. Anorectal malformation surgeries—in one or several procedures—imply frequent complications, such as dehiscence, intestinal occlusion, anal prolapse, bleeding, and urethral injuries, which increases morbidity and mortality and compromises quality of life. The primary objective of this work was to analyze the incidence of postoperative complications in patients undergoing anorectal malformation surgery in our department, whereas the secondary objective was to identify predicting factors that help approach and minimize them.

MATERIALS AND METHODS

A retrospective review of patients aged 0-18 years old undergoing anorectal malformation (ARM) surgery from 2006 to 2023 was carried out. The initial sample consisted of 137 patients, but 6 death cases, 17 patients > 18 years old, and 25 patients without ARM (anterior anus, intestinal duplication) were excluded. For statistical analysis purposes, the sample was divided into patients with and without complications (complications YES/NO) (Fig. 1).

Demographic variables (age, sex), associated malformations (genitourinary, cardiac, limb, vertebral, and others such as esophageal or duodenal atresia), and age and repair surgery (posterior sagittal anorectoplasty “PSARP” or laparoscopically assisted colorectal pull-through, according to the type of malformation) operating times were collected.

The presence and type of colostomy (loop, divided ends, Hartmann), previous intestinal preparation (25 mg/kg polyethylene glycol 4000 emptying solution through a nasogastric probe and 10 ml/kg warm saline solution rectal irrigations 24-48 hours before surgery vs. management without preparation), presence and type of surgical complications (intestinal occlusion, anal prolapse, anoplasty stenosis, bleeding, dehiscence, extrusion, anoplasty misposition, urethral perforation, and stomal complications) were also included.

As far as the PSARP procedure is concerned, the Peña technique⁽²⁾ was employed. The patient was placed in a prone position, with their pelvis raised. The limits of the sphincter complex were marked using a neurostimulator, and the fistula was dissected until the rectal pouch had been correctly identified. The latter was freed, and the new anoplasty was conducted in the center of the sphincter complex. The rectum was fixated in its posterior wall, the perineal body was reconstructed, and a layered closure was applied.

Colorectal pull-through was laparoscopically assisted in all cases⁽³⁾, with the patient in a supine position, with their legs apart. 5 mm ports were used in the left and right flanks. The rectum was dissected from the peritoneal reflection, and

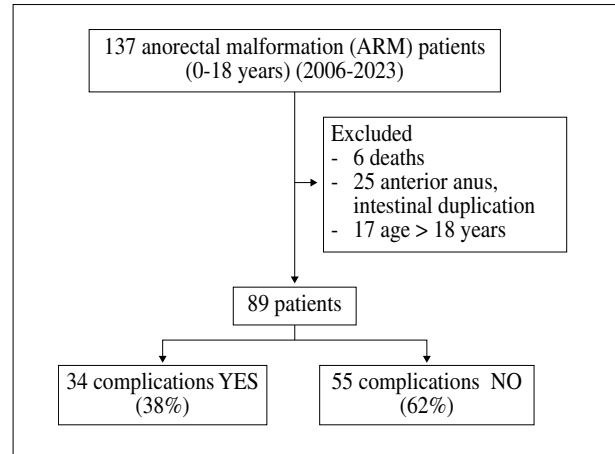


Figure 1. Study design

the relevant fistula was then ligated. Subsequently, a 10mm port or a mini-PSARP—on a case-by-case basis—were introduced through the perineum, and rectal pull-through was carried out, while ensuring that vascularization was not compromised and anoplasty did not remain under tension. The neurostimulator was employed, and the anus was fixated.

Patients remained in hospital with parenteral nutrition and antibiotic therapy (intravenous 100 mg/kg/day ceftriaxone + 10 mg/kg/8 h metronidazole). Daily anoplasty dressings with saline solution and aqueous chlorhexidine were performed. Dilations were initiated 2 weeks following surgery until the Hegar dilator size according to patient age was achieved, as typically performed in most institutions⁽²⁾.

For statistical analysis purposes, the SPSS Statistics software (version 29.0) was used, and the Chi-square test, Mann Whitney U test, and Student’s t-test were applied. Statistical significance was established at $p < 0.05$, with a 95% confidence interval.

RESULTS

89 patients underwent surgery. 44 were boys and 45 were girls. Median age was 7 years (3-18). According to Peña’s classification, the most frequent ARM was rectoperineal fistula (46/89, 52%), followed by rectovestibular fistula (17/89, 19%).

In 36% (32/89) of the patients, the ARM was isolated, whereas in the remaining ones (64%, 57/89), it was associated with other abnormalities. The most frequent were cardiac abnormalities (patent foramen ovale), which were recorded in 38 cases, and genitourinary abnormalities (vesicoureteral reflux), which were noted in 34 cases. In addition, 9 patients had syndromes—6 VACTERL (vertebral, anorectal, cardiac, tracheal, esophageal, renal, and limb) associations, 3 Currarino syndromes, and 1 DATE (duodenal atresia, anorectal malformation, and esophageal atresia).

Baseline treatment was PSARP in 61 (69%) patients and colostomy in 24 (27%) patients (4/24 loop, 1/24 Hartmann, and 19/24 divided ends) –4 patients were treated in a different institution. In colostomy patients, posterior sagittal anorectoplasty was subsequently conducted in 5 cases, and laparoscopically assisted rectal pull-through was carried out in 19 cases.

Median age at PSARP was 5.4 months (5 days-7 years), with a mean operating time of 112 min (38-259).

Patients remained in hospital for a median of 6 days (4-10). Nothing by mouth with parenteral nutrition was maintained for a median of 3.8 days (3-7), and antibiotic therapy (intravenous ceftriaxone + metronidazole) was administered for a median of 4.4 days (3-10).

The incidence of complications was 38% (34/89). 17 patients (19% of the total) had anal prolapse, with a third of them requiring reintervention as a result of bleeding or pain. 15 patients (17% of the total) had anoplasty dehiscence, with 56% of them needing reintervention and 66% requiring colostomy. According to the Clavien-Dindo classification, 50% were category IIIb instances, with general anesthesia needed for review or resolution purposes (Table 1).

3 patients had anoplasty bleeding, with 1 of them requiring reintervention twice. This patient was then diagnosed with a coagulation disorder (Von Willebrand disease). 5 patients had stenosis, which was resolved with anal dilations. There was 1 particular case of mucosal necrosis –a 7-year-old boy diagnosed with anorectal malformation in his home country and referred to us with and end colostomy without imaging tests or a clear diagnosis. He underwent colorectal pull-through, but postoperative

Table 1. Complications according to the Clavien-Dindo classification.

Complication grade	Number of patients
I	8
II	3
III	
- IIIa	0
- IIIb	17
IV	
- IVa	5
- IVb	1
V	0

I: Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside. **II:** Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included. **III-IIIa-IIIb:** Requiring surgical, endoscopic or radiological intervention. Intervention not under general anesthesia. **IV-IVa-IVb:** Life-threatening complication (including brain hemorrhage, hemorrhagic stroke, subarachnoid hemorrhage) requiring IC/ICU-management. Single organ dysfunction (including dialysis). Multiple organ dysfunction. **V:** Death of a patient.

progression was unfavorable, which led to a new protection stoma and a new anoplasty on day 7.

No differences in terms of demographic characteristics were found between the groups (complications YES/NO) (Table 2).

Table 2. Group-based (complications) analysis of demographic variables and associated malformations.

	Complications NO (N= 55)	Complications YES (N= 34)	p value
Age (years)	5.9 (0-18)	6.8 (0-18)	0.12
Type of ARM			
- Rectoperineal	29	17	0.08
- Rectovestibular	12	5	0.15
- Bulbar rectourethral	3	2	0.18
- Prostatic rectourethral	2	4	0.23
- Rectovesical	0	1	0.50
- Cloacal	2	2	0.45
- No fistula	2	2	0.33
- Anal stenosis	5	1	0.28
Associated malformations			
- None	23	9	0.060
- Genitourinary	9	8	0.088
- Cardiac	9	6	0.095
- Vertebral/sacral	8	7	0.113
- Limbs	3	2	0.343
- Other (esophageal/ duodenal atresia...)	3	2	0.078

Table 3. Analysis of predicting variables: previous intestinal preparation, colostomy and colostomy type, age and repair surgery operating times.

	Complications NO (N= 55)	Complications YES (N= 34)	p value
Previous intestinal preparation			0.001
- Yes	48	7	
- No	7	27	
Colostomy			0.05
- Yes	11	13	
- No	44	21	
Colostomy type			0.81
- Loop	1	3	
- Divided ends	10	9	
- Hartmann	0	1	
Age at repair surgery (PSARP/pull-through) (years)	0.46 (0.16-0.7)	1.1 (0.1-7)	0.047
Repair surgery operating time (min)	110 (45-188)	117.5 (38-259)	0.073

Statistically significant differences were noted between both groups in terms of intestinal preparation ($p= 0.001$, -1.49 95% CI: -2.69 to -1.24), presence of colostomy ($p= 0.05$, -2.54 95% CI: -6.5 to -0.987), and age at surgical repair ($p= 0.047$, 1.198 95% CI: 1.1-3.15) with the incidence of complications. The age-complications correlation score was 0.21 ($p= 0.046$), which means there was a small directly proportional relationship between both variables. No differences were found regarding operating time ($p= 0.073$) or type of colostomy ($p= 0.81$) (Table 3).

DISCUSSION

In our sample, the most common ARM was rectoperineal fistula (52%), contrary to the literature, where rectourethral (boys) or rectovestibular (girls) fistula is more frequent⁽²⁾.

In 36% of the patients studied, the ARM was isolated, whereas in the remaining ones (64%), it was associated with other abnormalities. This is consistent with the literature, where abnormalities have been reported in up to 64%, especially in boys and in complex forms⁽⁴⁾.

The total incidence of complications in our series was 38%, slightly above the literature (up to 33%)⁽⁵⁾.

Rectal prolapse was found in 19% (3-78% in other studies)⁽⁶⁾. Most (> 98%) cases were detected in the late postoperative period (> 1 month). According to the literature, it may occur as a result of the surgical technique used (rectal fixation, anoplasty tension) or suboptimal/late constipation management. In addition, only ≥ 5 mm rectal prolapses were considered, since this is the threshold established by the literature as capable of causing complications (bleeding, mucus, ulceration), and therefore, as prone to surgical treatment⁽⁶⁾.

Perineal wound dehiscence was found in 17%, consistent with the range described in the literature (11-31%)⁽⁷⁾. They were all diagnosed in the first 15 days post-surgery. It should be highlighted that, in our series, up to 56% required reintervention, and 66% underwent colostomy, whereas in other studies, resolution with medical treatment was achieved in all cases⁽⁷⁾. Preoperative intestinal preparation reduced the incidence of complications, especially anoplasty infection and dehiscence, contrary to other studies, where no differences were found ($p > 0.05$)⁽⁷⁾.

Regarding colostomy, it should be noted that intestinal diversion reduces the risk of anoplasty-related complications, such as wound dehiscence or infection^(8,9). However, the complications inherent to this type of surgery, such as peristomal skin burn, infection, dehiscence, bleeding, management of losses, and need for subsequent surgery⁽⁹⁾, should also be considered. In our sample, 19 colostomies were performed, of which 1 presented prolapse, 1 stenosis and another evisceration (requiring reintervention); dehiscence was found in 2 cases and peristomal burn with ulceration in 2 cases, all managed with medical treatment.

The most frequently employed colostomy type in our institution –even considering that a case-by-case approach is used– is Peña's divided ends colostomy, which avoids fecal contamination of the distal fistula and allows for a distal colostogram so that the malformation can be subsequently assessed⁽¹⁰⁾. In this respect, no differences were found between the type of colostomy and the presence of postoperative complications (Table 3, $p= 0.81$), consistent with other articles⁽⁹⁾. However, other studies suggest that divided ends colostomy is associated with greater incidence of skin excoriation (17 loop vs. 10 divided ends, $P= 0.04$)⁽¹⁰⁾.

Patients underwent surgery at a median age of 5.4 months, contrary to other studies, where the repair surgery

was conducted at 3 months of age⁽¹¹⁾, and even at the age of 4-8 weeks old. This proves advantageous as it means the repair is carried out before complementary nutrition is introduced, with the resulting improvement in terms of constipation and fecal continence⁽¹²⁾. The delay can be partly explained because, in our medium, there are cases of late diagnosis and delay in assessment by a specialist. On the other hand, we observed that, in our sample, age was associated with an increased risk of postoperative complications in a statistically significant manner ($p= 0.047$). Continence in early repair patients is better than in late repair ones according to Wingspread's modified classification. This may be due to the fact the surgical repair of the perineal and anorectal areas' normal anatomy allows for an adequate development of the neuronal and muscle structures involved in the defecation process⁽¹³⁻¹⁵⁾.

Regarding limitations –apart from the aforementioned ones–, our study had a small sample size, and it was observational and retrospective.

In conclusion, the development of postoperative complications following ARM surgery was frequent and significant in our series, with complications occurring in more than one third (38%) of the patients. In this respect, intestinal preparation, presence of colostomy, and age at repair could impact the incidence of postoperative complications. Therefore, intestinal preparation and colostomy could stand as protective factors in the development of complications following anorectoplasty (RR= $-1,49$ and -2.54 , respectively). In addition, we observed age would increase the risk by 1.2-fold.

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