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Robotic-Assisted Laparoscopic Resection of Tailgut Cysts

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ABSTRACT

Introduction: Tailgut cysts are rare remnants of the embryological hindgut. Resections are difficult to perform due to the narrow and delicate presacral space where they are usually located. Many different approaches have been described, but to date, no studies have been performed concerning robotic assisted surgery for this entity. Therefore, we conducted a retrospective analysis to evaluate the feasibility and outcome parameters of the robotic anterior approach for resection of tailgut cysts and to compare our results with available literature.

Material and Methods: Data was retrospectively obtained from hospital records of all patients who underwent robotic assisted resection of tailgut cysts between January 1, 2017 and June 30, 2020. Outcomes include baseline characteristics, pre-operative radiological workup, operative time, intra- and postoperative complications, and histopathological results.

Results: Between January 1, 2017 and June 30, 2020, five patients underwent robotic resection of tailgut cysts. All patients were female and mean age was 47.2 years (range 31.6–63.1 years). Only one patient reported to have local symptoms that could be attributed to the tailgut cyst. Median tumor size was 42 mm (range 30–64 mm). There was no conversion and median operating time was 235 minutes (range 184–331 minutes). Four patients had additional procedures. Intra- and postoperative complications included one intra-operative injury of the rectal wall, which was immediately oversewn, and one postoperative presacral hematoseroma with mild neurological symptoms. None of the specimens showed signs of malignant transformation in histopathological workup.

Conclusion: This retrospective analysis shows that robotic resections of tailgut cysts are feasible and safe. Regarding the localization of tailgut cysts in the presacral space, the robotic assisted anterior approach is excellently suited, especially if the cysts are localized above the levator muscle. Longer operative times and higher material costs are outweighed by precise and safe preparation with a robotic platform in this delicate region and confined space. We recommend the robotic assisted anterior approach for the resection of tailgut cysts and retrorectal lesions in general.

Key Words: Tailgut cyst, Retrorectal hamartoma, Minimal invasive surgery, Robotic surgery.

INTRODUCTION

For the last decade, the number of minimally invasive abdominal procedures and especially robotic assisted operations has increased steadily.[1] The advantages of minimally invasive surgery, e.g., less intraoperative blood loss and postoperative pain, reduced length of hospital stay as well as quicker return to normal activities and work are even more pronounced by the introduction of robotic assisted techniques.[2] Especially in confined and narrow spaces, introduction of robotic assisted systems and platforms has led to even more precise dissection techniques. Further advantages are a tremor and motion filtration, the endowrist function with superior maneuverability of the instrument, three-dimensional binocular vision imaging, and motion scaling.[3,4] This explains why resections of para and retro-rectal tumors such as tailgut cysts are particularly suitable operations for robotic surgery.

Although agreement exists for the advantages of robotic surgery for rectal and esophageal cancer, nevertheless literature and scientific evidence for other procedures is lacking.[5] Despite clinical outcome parameters including

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lower conversion rate to open surgery, comparable length of hospital stay, and return to social activities and work and recovery time, skeptics claim higher overall costs, longer operative time, and the admittedly longer learning curve for robotic surgery.[5,6]

Tailgut cysts, also known as retrorectal hamartomas are rare remnants of the embryological hindgut when incomplete involution occurs during embryogenesis.[7–9] The prevalence of tailgut cysts is 1/40,000 and the female to male ratio is 7:1.[10,11] These cysts are usually found in the presacral space, a narrow space between the lower rectum anteriorly, the coccyx and sacrum posteriorly, the peritoneal reflection superiorly, and the levator ani and pelvic floor inferiorly. Additionally, difficile structures like the iliac vessels, the ureters, and the parasympathic nerves can be found adjacent to the presacral space. Tailgut cysts are mostly an incidental diagnosis during routine gynecological workup or imaging for other abdominal or spinal complaints and diseases.[8] However, when detected, an magnetic resonance imaging (MRI) is the imaging of choice to determine location and preoperative risk of malignancy.[11,12] Nevertheless, some authors describe in approximately 50% of patients unspecific symptoms resulting from local mass effects such as constipation or abdominal pain.[8,13] Complications like infections, bleeding, or malignant transformation are rare (estimated life-time risk 6%–14%).[8] Therefore the treatment of choice is complete resection of the lesion.[8,11–14] Many different resection methods have been described.[15] Anterior approaches by laparoscopic or open abdominal surgery are frequently used for tumors located pre and pararectally above S3 level.[12,13,16] The posterior inter-sphincteric or paracoccygeal approaches are advantageous to resect tailgut cysts below coccygeal level and the levator ani muscle.[17] Even transanal minimally invasive resections or distal segmental rectal resections with recto-anal anastomosis are described in literature.[18–21]

Six years ago the robotic approach was introduced for low rectal resections in our hospital. The above mentioned advantages led to resecting all tailgut cysts with the robotic technique.

The aim of the present study was to evaluate all patients, which have undergone a robotic assisted resection of tailgut cysts in our hospital and compare outcome parameters with the available literature.

MATERIAL AND METHODS

Inclusion and Exclusion Criteria

The present study was approved by the local Institutional Review Board (Ethikkommission Nordwest- und Zentralschweiz (EKNZ), Project-ID 2020–02750).

All patients aged ≥ 18 years and undergoing robotic assisted laparoscopic resection of a tailgut cyst between January 1, 2017 and June 30, 2020 were included in this study. A retrospective analysis was performed. All patients were pre-operatively informed about the surgical technique.

Data Collection

Data was retrospectively obtained from written hospital records, electronic databases (EPIC©) as well as pathology and radiology reports. Demographic data (age, sex, body mass index [BMI], American Society of Anesthesiologists [ASA] score) as well as outcome parameters were extracted: Conversion to open surgery, intra- and postoperative complications, operative time, diverting stoma formation, postoperative length of hospital stay, and re-operation rate. Data was extracted from medical records and transferred into a predefined data sheet. MR images were assessed by a trained radiologist (AW).

Surgical Technique

We routinely used the da Vinci Si® platform for the robotic assisted resections. Five trocars were used and the rectum was mobilized from lateral right beginning at the promontory. The cysts were excised completely and the specimen was histologically examined to exclude malignancy.

The optic trocar was placed cranial and right of the umbilicus in a semi-open approach and the pneumoperitoneum up to 12 mm Hg was installed. Under laparoscopic view four further trocars were placed: one in the right lower abdomen (8 mm, Da-Vinci®), one in the left upper abdomen (8 mm, Da-Vinci®), one in the left lower abdomen (8 mm, Da-Vinci®) and a 12 mm trocar in the right abdomen at umbilical height. The patient was placed in the Trendelenburg position and the small intestine was positioned in the right upper quadrant before docking the robotic system (Da-Vinci Si®).The right pararectal peritoneal layer at the height of the promontory down to the bladder was opened. Presacral preparation was then performed with special care to the hypogastric nerve plexus and the deep pelvine plexus. The cysts were resected by dividing them from the rectal wall and dissecting them from the levator ani muscle. When cysts were accidentally opened, the fluid was immediately evacuated. The resected tailgut cysts were placed into a bag and then extracted through the umbilical incision. Incisions were closed with absorbable sutures.

Table 1.
Patient Information

Patient#	Age (Years)	Gender	American Society of Anesthesiology Score	Body Mass Index (kg/m^2)	Reason for Imaging	Previous Abdominal Surgery
1	36.1	Female	2	24	Endometriosis	Yes
2	63.1	Female	2	30.9	Diverticulitis	No
3	49.4	Female	2	28.4	Routine gyneco-logical workup	Yes
4	55.9	Female	2	22.7	Workup for aortic aneurism	Yes
5	31.6	Female	2	22.2	Endometriosis	Yes

All operations were performed by one single robotic colorectal surgeon who is very experienced in robotic colorectal surgery.

Statistical Analysis

Descriptive statistics are presented as absolute frequencies for categorical variables and mean with standard deviation (SD) for continuous variables. Statistical analysis was done with SPSS (Version 25). Graduation of complications was performed using the Clavien-Dindo classification.

RESULTS

Baseline Characteristics

Between January 1, 2017 and June 30, 2020 five patients underwent robotic laparoscopic resections of tailgut cysts. All patients were female and had an ASA-classification score of 2 points. Mean age was 47.2 years (range 31.6–63.1 years) and mean BMI was 25.6 kg/m^2 (range 22.2–30.9). In all patients the diagnosis was an incidental finding due to radiological workup for other entities. Two patients had imaging for endometriosis, one patient had a computed tomography scan for recurrent diverticulitis. The remaining two patients had routine gynecological workup or workup for aortic aneurysm with underlying positive family history. Only one patient reported to have rectal pain during defecation after systematical questioning in the pre-operative consult. Four out of five patients had previous abdominal surgery. Details can be seen in **Table 1**.

Pre-Operative Radiological Workup

Median tumor size was 42 mm for maximal diameter (range 30–64 mm). All tailgut cysts were located above the levator muscle and sub-peritoneal in the retrorectal space. Four out of five cysts were located pararectal at the level of the os coccyges and one cyst was in direct contact to the sacral bone at level S3-S5 retrorectally. Three out of five lesions were multicystic in pre-operative MRI (**Figure 1**).

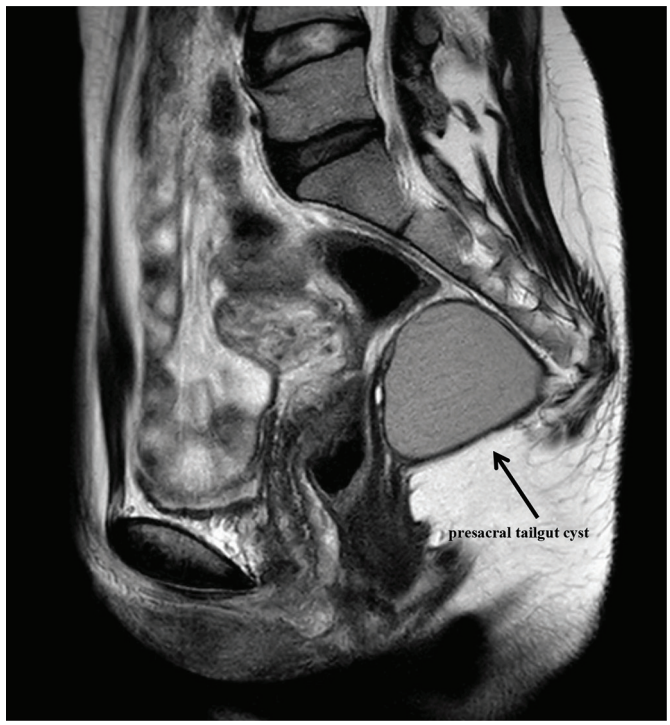

Figure 1. Magnetic resonance image (Patient 5).

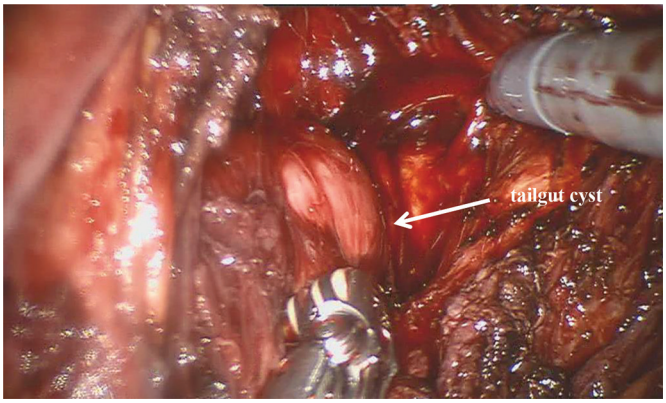

Figure 2. Intraoperative image (Patient 5).

Operation

All operations were performed in robotic-assisted laparoscopic technique without the need for conversion to open surgery. Median operating time was 235 minutes (range 184–331 minutes). In four out of five patients an intra-abdominal drain (Jackson-Pratt or Easy Flow) was placed. One patient received a loop ileostomy due to an intraoperative injury of the rectal wall. Four patients had additional surgical procedures during the same operation. Adhesiolysis was performed in two cases, endometriotic lesions were resected in another patient. One patient was scheduled for additional sigmoidectomy for diverticulosis but after resection of the tailgut cyst anaesthesiological problems with ventilation occurred and we decided to resect the leading diverticula with a linear stapler (Endo-GIA). Minor reconstruction of the pelvic diaphragm with resorbable sutures after resection of the tailgut cysts was required in three patients. Mean length of hospital stay was 5.6 days (range 4–7) (**Figure 2**).

Postoperative Histopathologic Workup

None of the specimens showed signs of malignant transformation. All specimens had peritumoral fibrosis and contained epithelial cells of different quality and smooth muscle cells (**Figure 3**).

Complications

In one patient peritumoral fibrosis rectal involvement of the tailgut cyst was present due to tissue fibrosis, and it was impossible to differentiate between cystic wall and rectal wall. This resulted in a 3 mm defect of the rectal wall and was closed immediately in a double layer fashion with absorbable interrupted sutures. Additionally, a loop ileostomy was created.

Only one 30 day-postoperative complication was found in a patient with presacral hematoseroma with mild neurological symptoms on level S1, which resolved spontaneously. This complication was rated Clavien-Dindo 1. All complications are listed in **Table 2**. To date, there are no reports of recurrence or mortality in the included patients.

DISCUSSION

To our knowledge this is the first analysis of robotic assisted laparoscopic resections of tailgut cysts. Only one formal and one video case report exist on this topic.[22,23] One case series of robotic resections of presacral tumors of all entities, but not specific for tailgut cysts can be found in literature.[24]

Results are compared with the literature of the anterior laparoscopic approach and the posterior approach.[12,13,16]

Tailgut cysts have a female to male ratio of 7:1.[10,11] Female predominance can also be seen in our patient group as all patients are female. During the last 4 years, only one male patient with high radiological suspicion of a tailgut cyst was referred to our department. Because of comorbidities and advanced age, a resection of the tailgut cyst was not recommended.

On principle, an MRI is the imaging of choice to determine location and pre-operative risk of malignancy.[11,12,14] Normally tailgut cysts present well-circumscribed, thin

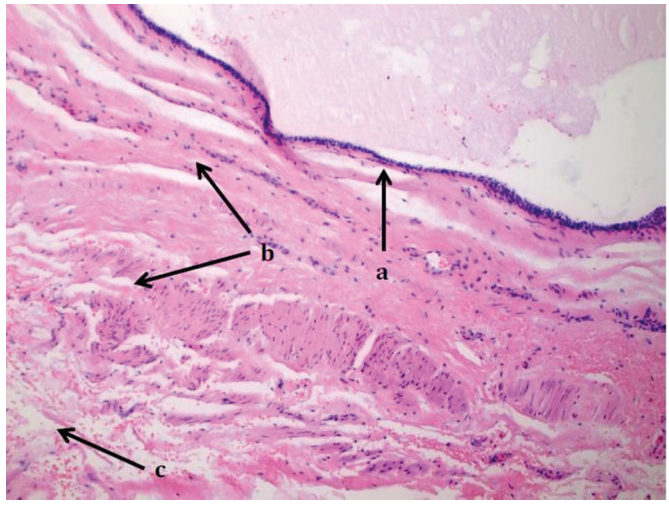

Figure 3. Microscopic sample (Patient 4). **a**, squamous epithelia; **b**, smooth muscle cells, **c**, connective tissue.

Table 2.
Additional Procedures and Complications

Patient#	Operation Duration (Minutes)	Additional Procedures	Intraoperative Complication	Postoperative Complication
1	321	Loop ileostomy, Reconstruction of pelvic diaphragm	Rectal wall injury	No
2	331	Adhesiolysis (50 min), Reconstruction of pelvic diaphragm, Resection of a sigmoid Diverticula	No	No
3	184	No	No	No
4	234	Adhesiolysis, Reconstruction of pelvic diaphragm	No	No
5	235	Resection of endometriotic tumors	No	Hematoseroma

walled, and hypointense on T1-weighted images.[8] Focal irregular wall thickening and enhancement after gadolinium injection are signs of malignant transformation.[8] Transanal or transrectal biopsies are not recommended to prevent potential seeding of tumor cells or infection of the cyst.[25] Also, histopathological differentiation between other developmental cysts as epidermoid cysts, dermoid cysts, or neurenteric cysts and tailgut cysts can be difficult with a biopsy sample.[25]

The life-time risk of malignant transformation is estimated to be 6%–14%, therefore treatment of choice is full resection of the lesions.[8,11–14] Histopathological staining of the commonly benign cysts show smooth muscle cells and different qualities of epithelial cells (squamous, columnar, cuboidal, or transitional).[12] Malignant transformation can be found in different cell types resulting in squamous cell carcinoma or more infrequently adenocarcinoma, neuroendocrine tumors, or sarcoma.[7,25] None of the specimens of the patients included in the present study revealed any signs of malignancy.

In our patients one intra-operative complication occurred. The patient presented with severe peritumoral fibrosis and the cyst inextricably involved the rectal wall. It was impossible to separate the cystic wall from the rectal wall. After complete resection a 3 mm defect of the rectal wall resulted and was immediately closed in a double layer fashion with absorbable interrupted sutures. Additionally, a loop ileostomy was created for safety reasons. Type and rate of intraoperative complications in our study is comparable with studies with an anterior laparoscopic approach. Sakr et al described two rectal injuries requiring formation of a loop ileostomy, (20%), two rectal serosal injuries (20%), and two vaginal injuries (20%) in 10 patients treated with the anterior laparoscopic approach.[12] One systematic review of case reports and small case series also including other entities of retrorectal tumors reported one rectal perforation in 20 patients (5%).[26]

Concerning 30-day postoperative complication rates, only one (20%) presacral hematoseroma occurred (Clavien-Dindo 1). The patient had mild neurological symptoms, which resolved spontaneously. This rate is comparable to the study of Sakr et al with a 10% overall postoperative complication rate for the anterior resection (pelvic floor dyssynergia and lower limb weakness).[12] Concerning the posterior approach Sakr et al reports a postoperative complication rate of 72.7%.[12] All of those patients suffered from wound seroma and infections (63.6% Clavien-Dindo II and 9.1% Clavien-Dindo III). Carpelan-Homström et al reported a 18% postoperative infection rate for the perineal technique, whereas in eight patients operated with the anterior transabdominal approach no complications occurred.[13]

Compared to a systematic review of Mullany et al including all entities of retrorectal tumors overall complication rate for laparoscopic resections is 16.2% and overall complication rate for robotic resections is three out of nine (33%).[27]

Various studies report longer operative times for robotic assisted procedures compared to laparoscopic operations.[5] Our median operative time for the robotic resection was much longer compared to the laparoscopic resections from the study by Sakr et al (median operative time 235 min. vs. 157 min.). Part of the difference in operating time can be attributed to the docking and undocking of the robotic system. In our experience, standardization of docking steps and repetitive training can reduce operative time significantly. Finally, all robotic procedures were finished without the need for conversion to open surgery. Sakr et al did not report any conversion to open surgery as well.[28]

Some experimental approaches describe transanal minimally invasive resections or distal segmental rectal resections with recto-anal anastomosis.[18–21] These approaches

are only described in case reports and thus cannot be compared with our outcome parameters.

Limitations

This is a case series of only five patients. To demonstrate that robotic assisted resection of tailgut cysts is safe and feasible, larger cohorts are necessary. Due to the rarity of tailgut cysts, a prospective study comparing the laparoscopic and robotic approach with a relevant number of patients is difficult to conduct.

Secondly, only one study was available to compare similar outcome parameters with our patients. Other studies included retro- and pararectal tumors in general which limits comparability.

Thirdly we did not perform a routine follow up with any imaging technique. Therefore, we cannot comment on potential recurrence rates of our robotic resected patients.

CONCLUSION

This retrospective case series shows that robotic resection of tailgut cysts is feasible and safe. The robotic assisted anterior approach is excellent, especially if the cysts are located above the levator muscle. Longer operative times and higher material costs are outweighed by precise and safe preparation with a robotic platform in this delicate region and confined space. We recommend the robotic assisted anterior approach for the resection of tailgut cysts and retrorectal lesions in general.

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