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ORIGINAL ARTICLE

Repair of parastomal hernia after Bricker procedure: retrospective consecutive experience of a tertiary center

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Abstract

Background Ileal conduit parastomal hernias (ICPHs) are frequent after radical cystectomy with ileal conduit urinary diversion, but their management is debated. This study aimed to review the results of ICPH repair according to Sugarbaker or Sandwich techniques, with special interest in ICPH recurrence and urological complications.

Methods The authors reviewed a consecutive series of patients undergoing ICPH repair between January 2014 and December 2020. Primary endpoints were ICPH recurrences at clinical exam and cross-sectional abdominal computed tomography (CT) scans. Secondary endpoints were any other complications possibly related to the ICPH repair.

Results Twenty-three patients underwent ICPH repair surgery (16 Sugarbaker and 7 Sandwich techniques) during the study period. Sixteen patients underwent a primary laparoscopic approach. All but one patient underwent at least one abdominal CT during the follow-up. Median clinical and CT scan follow-up times were 57 and 50.5 months, respectively. Clinical and CT ICPH recurrence rates were 4.5% and 13% at 5 years, respectively. Eighteen patients (78%) suffered no urological complications during the follow-up period, but three patients (13%) needed redo surgery on the urinary ileal conduit.

Conclusion The modified Sugarbaker or Sandwich techniques might be considered as promising techniques for ICPH repair with a low rate of recurrence. The urological complications, and particularly the ileal conduit-related issues, need to be evaluated in further studies. Controlled and prospective data are required to compare the Sugarbaker and Sandwich techniques to the Keyhole approach for ICPH repairs.

Keywords Hernia · Ileostomy · Colostomy · Complication · Abdominal wall

Introduction

Incisional hernias (IHs) are frequent complications that may occur after any abdominal operation [1]. Amongst them, parastomal hernias (PHs) represent a group of IHs particularly difficult to avoid or to correct, as their main cause is the abdominal wall defect that is needed to allow the passage of the bowel segment through the muscle up to the skin. Surgical repair of PHs might also be challenging [2] due to the facts that the abdominal wall defect cannot be completely closed, that the vascularization of the bowel segment has to be preserved, and that the bowel itself should not be strangulated within the repair.

Radical cystectomy (RC) with ileal conduit urinary diversion (Bricker procedure) [3] has become a common operation not only for bladder cancer, but also for benign indications such as neurogenic bladder, congenital anomalies, or radiation cystitis. Ileal conduit stomal complications, and particularly ileal conduit PHs (ICPHs), are frequently a

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cause of reintervention after RC with ileal conduit urinary diversion [4–6]. Following RC, ICPHs may cause urinary leaks and may also induce esthetic issues, abdominal discomfort or pain, and more rarely intestinal obstruction or strangulation [7]. Management of ICPHs has rarely been studied specifically [8] and has been based on that of PHs after colostomy or ileostomy, the most frequently occurring PHs. Indeed, the specific indications, the surgical techniques and the best type of mesh for the surgical repair of ICPHs have not yet been determined [8]. Compared to the surgical repairs of colostomy and ileostomy PHs, ICPHs are even more surgically complex, as ureters have previously been anastomosed to the ileal conduit and must be preserved during ICPH repair [8].

Modern techniques of PH repair can be performed in a minimally invasive way, mainly laparoscopically. They use meshes, either polypropylene/polyester meshes in sublay or onlay position, or intraperitoneal composite meshes in peritoneal position [2]. The most described techniques of PH repair are the Keyhole [9] and the adapted Sugarbaker [10] techniques, in addition to the combination of both, known as the Sandwich technique [11]. Sugarbaker and Sandwich techniques are reported to be superior to Keyhole repairs in terms of postoperative PH recurrence [2, 12]. These procedures, first described for colostomy and ileostomy PH repairs [2], have rarely been specifically described for ICPHs [13, 14] and their long-term results have not been reported in this setting [15].

The aim of this study was to review the experience of a tertiary university center with ICPH repair after RC using Sugarbaker or Sandwich techniques and to report the complications and long-term results of this experience, with special interest in ICPH recurrence and urological complications.

Materials and methods

This retrospective study was approved by the Ethics Committee of the CHU Liege, Belgium (reference 2022/224) that confirmed the fact that patient's consent is not necessary in pure retrospective studies in Belgium. The authors reviewed the medical files of a consecutive series of patients undergoing ICPH repair after previous open RC with ileal conduit urinary diversion between January 2014 and December 2020. Follow-up was fixed at December 31st, 2022, to allow a follow-up period of at least 2 years for all patients. Surgical repairs were performed by a senior surgeon (OD) experienced in abdominal wall surgery. Surgical follow-up consisted in a clinical exam at 1, 4 and 24 weeks after surgical repair.

Primary endpoints were ICPH recurrences at clinical exam and abdominal computed tomography (CT) scans. Secondary endpoints were any other complications possibly related to the ICPH repair. Patient' demographic characteristics, intra-operative data (duration of surgery, associated medial IH repair, surgical approach (open or laparoscopic), surgical technique, type of mesh) and postoperative evolution were retrieved from their medical files. Thirty-day postoperative surgical complications were registered according to the Clavien–Dindo classification [16]. When available, preoperative abdominal CT scans were retrospectively reassessed by a radiologist (MM) and a senior surgical trainee (LG) for ICPH defect diameter measurement and classification according to the modified Moreno-Matias [8, 17] (Table 1) and the European Hernia Society (EHS) PH grading systems [18] (Table 2). These preoperative CT scans were also analyzed for detection of associated medial IHs. Images from the latest postoperative cross-sectional abdominal CT scans (performed mainly for oncology or urology follow-up) were retrospectively reviewed for detection of ICPH recurrence.

Table 1 CT classification of parastomal hernia after radical cystectomy (8), adapted from Moreno-Matias (17)

Type	Content of the hernia sac
0	Peritoneum follows the wall of the ileal conduit, with no peritoneal sac
Ia	Bowel forming the ileal conduit with a sac < 5 cm
Ib	Bowel forming the ileal conduit with a sac > 5 cm
II	Omentum
III	Colonic or intestinal ileal loop other than the ileal conduit

CT computed tomography

Table 2 EHS classification for parastomal hernia (adapted from 18)

Concomitant IH	Small (≤ 5 cm)	Large (> 5 cm)
No	I	III
Yes	II	IV

Primary PH P; *recurrent PH* R

EHS European Hernia Society; *IH* incisional hernia; *PH* parastomal hernia

Surgical approach

The placement of an intraperitoneal mesh, as described by Sugarbaker [10], subsequently modified to allow a laparoscopic approach was the preferred method of ICPH repair when deemed feasible. The pure Keyhole technique was never used in this series. When the ICPH defect had a diameter of over 4 cm, a Sandwich technique [8] was preferred, using a Keyhole intraperitoneal mesh placed to reduce the abdominal wall defect followed by another intraperitoneal

mesh used to complete the repair in a similar way as in the Sugarbaker repair.

The type of mesh adopted varied according to availability and surgical preferences over the study period. The mesh used as a Keyhole mesh in the Sandwich technique had to be a composite mesh with a peritoneum side in polypropylene and an abdominal side covered with an hydrogel barrier permitting contact with the bowel (Sepramesh™ or Ventralight™, C.R. Bard, Inc., Murray Hill, NJ, USA). The mesh used to cover the ileal conduit in the Sugarbaker or Sandwich approaches had to be compatible with bowel contact on both sides, in part (Parietex™ Composite parastomal mesh, monofilament polyester coated with a collagen film, Medtronic, Dublin, Ireland) or completely (Physiomesh™, polypropylene coated with polydioxanone and poliglecaprone, Ethicon, Sommerville, NJ, USA; DynaMesh® Cicat, polyvinylidene fluoride, FEG Textiltechnik, Aachen, Germany). All meshes were fixed with permanent tackers (ProTack™ Medtronic, Dublin, Ireland; CapSure™, C.R. Bard, Inc., Murray Hill, NJ, USA) using a double crown technique without transfascial sutures [19].

Statistical analysis

For descriptive data on patient demographics and outcomes, median values with interquartile ranges (IQR) and extremes or proportions were calculated. Survival and recurrence rates were calculated using the Kaplan–Meier method. Prism 9 for macOS (Graphpad, San Diego, CA, USA) was used for descriptive statistics and data analyses.

Results

Patient and parastomal hernia characteristics

Twenty-three patients (13 males, 10 females; median age: 67 years, IQR: 56–76 years; extremes 44–83 years) underwent ICPH repair after open RC with ileal conduit urinary diversion during the study period. Indication for RC was malignant and benign bladder disease in 16 and 7 patients, respectively. Median time between RC and ICPH repair was 26 months (IQR: 17–39 months; extremes: 6–84 months). Two patients were kidney transplant recipients in whom the graft had been placed in the right iliac fossa and the transplant ureter anastomosed to the recipient ileal conduit. Median body mass index (BMI) was 25 kg/m^2 (IQR: 23–32 kg/m^2; extremes: 20–40 kg/m^2), and median American Society of Anesthesiologists (ASA) score was 2 (IQR: 2–3; extremes: 1–3). In two patients, ICPH was a recurrence after a previous failed repair, and 3 had a surgical history of open medial IH repairs. Risk factors for ICPH are presented in Table 3.

Table 3 Risk factors for ICPH in this series ($n = 23$)

Risk factor	*n*	%
BMI ≥ 30 kg/m^2	8	34.7
chemotherapy	3	13
past smoking	6	26
active smoking	8	34.7
COPD	7	30.4
diabetes	4	17.4
steroids	2	8.7
GFR < 60	10	43.4
proteins < 70 g/L	5	21.7

ICPH ileal conduit parastomal hernia; *BMI* Body mass index; *COPD* Chronic obstructive pulmonary disease; *GFR* glomerular filtration rate

A preoperative abdominal CT scan was available for 22 patients. Median ICPH defect diameter was calculated at 4.5 cm (IQR: 3.5–5.3 cm; extremes: 1.9–7 cm). In 20 patients the PHs were retrospectively classified as type III according to the modified Moreno-Matias classification, and in two as type II. According to the EHS classification of PH, 7 were classified type I, 8 type II, 4 type III and 3 type IV, meaning that an associated medial IH was detected in 11 patients (50%) (Fig S1).

Surgical procedure

Sixteen patients underwent a primary laparoscopic approach and 7 patients an open ICPH repair due to the necessity of repairing of a large associated medial IH (6 cases) and of a large left colostomy PH (1 case). Among the 16 laparoscopic approaches, two had to be converted to open surgery, one due to dense peritoneal adhesions and another due to ileal conduit ischemia secondary to vascular lesion necessitating a new ileal conduit. Median operative time was 77 min (IQR: 59–106 min; extremes: 41–247 min). The modified Sugarbaker repair was used in 16 cases and the Sandwich technique in 7 cases. Concerning the meshes used in the modified Sugarbaker repairs, Physiomesh™ were used in 9 cases, Parietex Composite™ in 5 cases and DynaMesh® in 2 cases. In the 7 Sandwich techniques, Sepramesh™ and Ventralight™ were used as Keyhole meshes in 6 and 1 cases, respectively, and covered with Physiomesh™ (4 cases), Parietex Composite™ (2 cases) and DynaMesh® (1 case). In 9 cases, a medial IH was repaired using a mesh in the same procedure (3 laparoscopic and 6 open IH repairs), and in one case an associated left colostomy PH was repaired using a Sugarbaker technique.

Postoperative course

Median postoperative hospital stay was 4 days (IQR: 3–10 days; extremes: 1–25 days). Fourteen patients (60%) developed no postoperative complications. Two patients developed grade 1 complications (urinary infection requiring antibiotics), one grade 2 (prolonged ileus), 2 grade 3a (change of ureteral drain in one case and percutaneous nephrostomy in another), 2 grade 3b (ileal conduit repair during the ICPH repair and infectious peritonitis requiring exploratory laparotomy), and 2 grade 4a (intensive care stay for respiratory infection attributed to inhalation). All patients without complications, but one, had been operated laparoscopically and their median hospital stay was 3.0 days (IQR: 2.7–4.2 days; extremes: 1–8 days). No mesh had to be removed during the first year of follow-up.

Clinical and CT scan follow-ups

Median clinical follow-up was 57 months (IQR: 39–88 months; extremes:12–106 months). No patient was lost to follow-up. One- and five-year survival rates were 100% and 77%, respectively. Six patients died during this follow-up period: 4 from cancerous diseases, one from renal insufficiency and infection, and one from respiratory failure.

One patient developed early clinical recurrence of ICPH graded III with a defect measured at 4.8 cm at last CT scan performed at 72 months after the repair (Suppl Fig. 2). This patient was a kidney transplant recipient with atrophy of the right rectus muscle due to the transplant incision, and who had undergone a modified laparoscopic Sugarbaker PH repair using a Physiomesh™. Early repair failure was clinically evident and confirmed on the postoperative CT scan performed three weeks after surgery. The patient refused a re-operation. No other patients were clinically diagnosed with recurrent PH. The rate of ICPH clinical recurrence was calculated at 4.5% at one, two, and five years. No patient was operated on for ICPH recurrence during the follow-up period.

All but one patient underwent at least one abdominal CT scan during follow-up. Median time between ICPH repair and last CT scan was 50.5 months (IQR: 25.6–77.7 months; extremes: 4–104 months). Besides the patients with early ICPH repair failure, 2 other patients had Moreno-Matias grade Ia ICPH recurrence retrospectively identified on abdominal CT scans. The first patient was a 53-year-old woman who had undergone a laparoscopic Sugarbaker PH repair using a Physiomesh™ for a grade III ICPH that included the caecum (Suppl Fig. 3A). Postoperative 6-month and 37-month abdominal CT scans demonstrated grade Ia recurrence (Suppl Fig. 3B). The second patient was a 72-year-old man who had undergone a Sandwich repair with Dynamesh® and Ventralight™ meshes for a grade III EHS and Moreno-Matias ICPH (Fig. 1A). Postoperative 10-month and 24-month abdominal CT scans demonstrated grade Ia recurrence (Fig. 1B). These 2 patients suffered no clinical symptoms or bulging secondary to these small ICPHs detected on CT scans and were not reoperated on or particularly followed. Radiological recurrence ICPH rate was calculated at 13.5% at one, two, and five years. Three patients developed medial IHs during the follow-up period, of which one needed open surgical repair.

Urological complications

Eighteen patients (78%) experienced no urological complications during the follow-up period. However, three patients (13%) needed redo surgery on the urinary ileal conduit. The first one needed immediate intra-operative ileal conduit redo due to ischemia. The second one was a 44-year-old male patient with obesity (BMI: 34 kg/m^2) and type 2 diabetes, who suffered from recurrent ICPHs after an open PH and

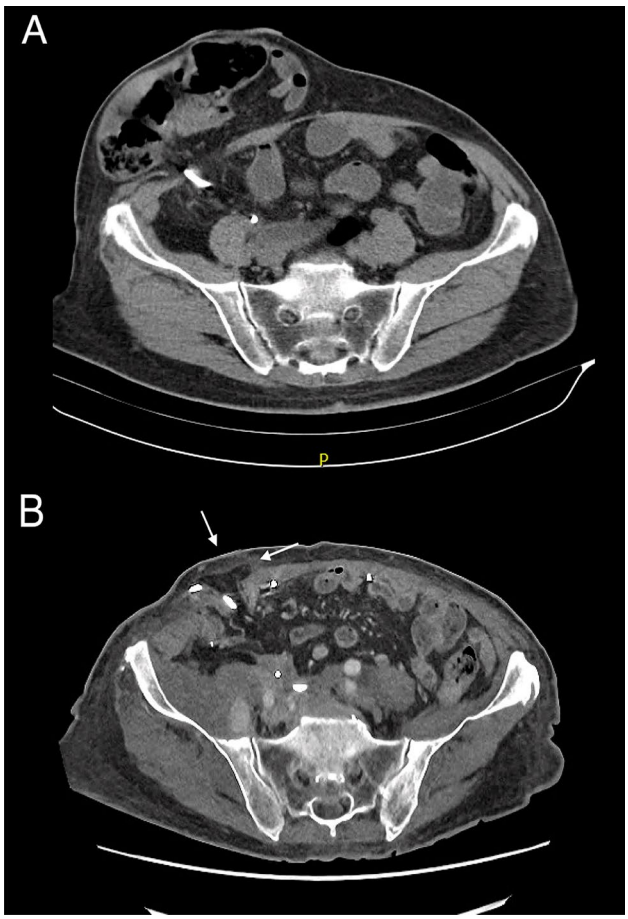

Fig. 1 Pre- (**A**) and post- (**B**) operative computed tomography a male patient suffering from a radiologically-identified Moreno-Matias grade Ia recurrence (white arrows on **B**) 24 months after a modified Sandwich procedure. Ureter drains were present in the ileal conduit on both exams

medial repair with mesh performed in another institution. He underwent an open ICPH redo repair according to the Sugarbaker technique with a Physiomesh™. He subsequently developed refractory chronic urinary infections and an ileoscopy through the urinary conduit showed parts of a polypropylene mesh. The patient had to be reoperated on to remove this part of the mesh that had migrated into the ileal conduit. The conduit was successfully repaired but healed with stenosis requiring frequent drainages. The third case of ileal conduit redo surgery involved a woman who suffered from repeated urinary infections before and after the ICPH repair, required multiple percutaneous nephrostomies and finally had an ileal conduit redo operation 10 months after the ICPH repair. She died three months later from renal failure and repeated urinary sepsis.

One patient, who had ureteral catheters before the ICPH repair, needed several replacements of these catheters. An additional patient, who had already required ureter drains before the ICPH repair, needed a nephrostomy 44 months after ICPH repair.

Discussion

This retrospective monocenter study showed that, in experienced hands, the surgical repair of ICPH according to the Sugarbaker or Sandwich techniques could provide excellent results with clinical and CT scan recurrences being 5% and 13% at 5 years, respectively, at the cost of a urological morbidity that should not be underestimated. These results are important as indications for RC are increasing and as the rate of ICPHs after RC according to Bricker's technique could be from 30 up to 50% [6, 20, 21]. A part of these ICPHs are radiological findings, but the majority might become symptomatic and might impair the patient's quality of life. Up to now, very few studies have specifically evaluated the results of the different repair techniques in ICPH after RC, which have been adapted from colostomy and ileostomy PH repairs. A national Finish retrospective study evaluating the results of 28 PSH repairs after RC (18 Keyhole and 10 Sugarbaker techniques) over a 10-year period in 5 hospitals reported in 2021 a clinical recurrence rate of 18% after a median follow-up of 30 months [13]. More recently, Bel et al. retrospectively reported 51 cases of PSH repairs after RC (21 Keyhole, 10 Sugarbaker and 20 various other techniques) in 6 French academic hospitals over an 8-year period. They reported 35% of recurrence after a median follow-up of 15 months, particularly in the Keyhole repair group (52%) [14]. This monocentric series of 23 patients who underwent Sugarbaker or Sandwich repairs is therefore important compared to the experience of other groups, and the cross-sectional abdominal CT scan study with a four-year median follow-up provides interesting and objective informations.

These data are also important as ICPH is a frequent complication of RC. Surgical prevention of ICPHs after RC, with [22] or without [23, 24] use of mesh, is currently under investigation by many groups, as it was studied for IH after laparotomy [25]. Future studies might prove that this prevention could be an important step to improving the quality of life of RC patients [15] and could also be cost-effective [26]. Of note, bowel occlusion due to ICPH is a very rare event, and none of our patients were operated on for this indication during the study period. Rather than avoidance of a potential acute complication, ICPH surgical repair decision should be based on the symptoms and the impairments of the patient's quality of life, and not on imaging or clinical exams. All our patients were symptomatic and their ICPHs were retrospectively assessed predominantly (90%) as grade III, the most severe level of the Moreno-Matias grading system. In fact, due to its situation, the ICPH often includes caecum and part of the right colon but is regularly easy to reduce.

The surgical techniques used for ICPH after RC have been adapted from colostomy and ileostomy PH repairs. Direct defect sutures without mesh should be abandoned due to an inacceptable recurrence rate [2] and stoma relocation seems particularly difficult for urinary ileal conduit [8]. Based on their experience with PH repairs and the literature [2] the authors, as others [13], preferred the modified Sugarbaker repair technique for ICPHs, with the use of an intraperitoneal mesh, with or without further Sandwich reinforcement using a Keyhole mesh. This technique can be performed in a minimally invasive laparoscopic approach if locally possible, as in ICPHs, multiple factors such as dense peritoneal adhesions, associated large medial IHs, previous ventral hernia or IH repairs, or kidney transplantation might require direct open surgery or conversion after laparoscopic attempt. Particularly in PSH repair after RC, the Keyhole technique seems to suffer from unacceptable recurrence rates [13, 14]. Recently, the robotic approach was proposed in ICPH repair, but its advantages are yet to be proven in terms of operative time, length of hospital stay, cost effectiveness or even long-term results [27, 28]. The debate concerning the best surgical technique is still open, as Laycock et al. recently reported interesting results with the original Keyhole technique [29] and Tully et al. with a modified Keyhole approach using the IPST DynaMesh® (FEG Textiltechnik, Aachen, Germany) [30]. However, the clinical and radiological results of this present series are among the best reported and add scientific arguments in favor of the modified (laparoscopic) Sugarbaker technique for ICPH repairs. It is clear that surgical experience matters in such challenging PH repairs [31, 32] and that centralization of these cases could improve the overall outcome [33].

In this series, 20% of the patients suffered from urological complications that could be linked to ICPH repair, including three patients (13%) needing a redo of their urinary ileal conduit. The first was clearly an acute surgical event due to surgical devascularisation of the ileal conduit. Another patient needed a revision due to mesh migration into the ileal conduit, this patient had a recurrent ICPH after a first failed repair and if it was therefore difficult to assess if the first or the second repair was the cause of the problem. The third one had previous refractory stenoses that had not been solved by the ICPH repair. She was reoperated on for refractory urinary infection and ultimately died from kidney failure and recurrent infection. The possibility of specific complications related to the use of mesh in an ileal conduit setting has been raised by others [34] and calls for a cautious attitude in patient selection, indication for repair and long-term follow-up. The events of urinary tract infection requiring percutaneous nephrostomy or ureter drains are not infrequent after Bricker procedure, and it is not clear from the authors' point of view if the ICPH repair increased the risk of such events in this series. The authors consider that during the procedure the ileal conduit should not be too tightly fixed between the abdominal wall and the Sugarbaker mesh, to potentially decrease the risk of mesh migration and conduit ischemia or stenosis.

In this study, several types of meshes and fixation devices were used according to commercial availability and technical progress. A mesh with anti-adhesive properties on both sides is necessary for the Sugarbaker repair, and the authors frequently used Physiomesh™ for these properties before its retraction from the market due to a higher incidence of recurrence [35]. Physiomesh™ was the mesh used in the only symptomatic repair failure of this series. More recently, the authors have used the flat DynaMesh® with good preliminary short-term results.

The limitations of this study are mainly linked to its uncontrolled and retrospective, monocentric design and to the relatively small size of this series. The clinical follow-up was also random due to the purely retrospective study design of the study. It would be interesting to prospectively evaluate the quality of life of the patients before and after the procedure, and especially the occurrence of pain due to the mesh repair. The use of different meshes and devices does not allow any conclusion on the relation between the type of mesh, the fixation device and the occurrence of repair failure, but reflected the "real life" of abdominal wall surgery and the relatively long period of inclusion in this series.

In conclusion, in view of this experience, the modified Sugarbaker techniques might be considered as promising techniques for ICPH repair, with a low rate of recurrence and an acceptable morbidity. However, it should be reserved for Moreno-Matias stage II and III symptomatic ICPHs. The urological complications, and particularly the ileal conduit-related issues, need to be evaluated in further studies. Controlled and prospective data are needed to compare the Sugarbaker or the Sandwich techniques to the Keyhole approach for ICPH repairs after Bricker procedure.

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Data availability The authors confirm that the data presented in this study will be available on request to the corresponding author.

Declarations

Conflict of interest The authors have no financial disclosure and have no conflict of interest concerning this study. Author Lauranne Goffioul, author Daniel Zjukovitsj, author Martin Moise, author David Waltregny, Authors Olivier Detry, have no financial disclosure and have no conflict of interest concerning the study entitled "Repair of parastomal hernia after Bricker procedure: retrospective consecutive experience of a tertiary center" submitted for publication in Hernia as an original paper.

Ethics approval The Ethical Committee of the CHU Liege, Belgium reviewed and approved this study (Reference 2022/224).

Consent to participate Not applicable.

Consent for publication Not applicable.

Availability of data and material The anonymised data are available upon request to the corresponding author.

Code availability Not applicable.

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