CASE REPORT

Rare postoperative complication: *Clostridium perfringens* septic shock following elective abdominal surgery

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Accepted 25 September 2017

SUMMARY

Postoperative infections are one of the most common complications in general surgery, and while rates have reduced with the routine administration of perioperative antibiotics, around 5% of patients undergoing a surgical procedure will develop an infective complication.¹

The Gram-positive, obligate anaerobe, *Clostridium perfringens*, is a well-known pathogen that forms part of both the environmental and gastrointestinal flora.² While more commonly associated with food poisoning, anaerobic cellulitis and traumatic gas gangrene, rare cases of spontaneous non-traumatic gas gangrene of abdominal viscera have also been recorded.³ Although potentially treatable with appropriate antibiotic cover, cases of *C. perfringens* can rapidly progress into fulminant and fatal sepsis.⁴ Moreover, the timing of symptom onset postoperatively can vary significantly, reports ranging from hours to days.^{5,6} We report a case of *C. perfringens*-induced septic shock following elective bowel resection.

CASE PRESENTATION

An 81-year-old man, with a medical history of hypertension and benign prostatic hypertrophy, underwent a laparoscopic-assisted ultra-low rectosigmoid resection and formation of an end colostomy for Dukes' A adenocarcinoma of the rectum. He had previously received successful neoadjuvant radiotherapy with no notable complications and was at performance status zero at the time of surgery. He received one dose of intravenous co-amoxiclav at induction, as per local protocol for surgical prophylaxis.

His clinical recovery was initially uneventful until 7 days postoperatively when his condition began to deteriorate. While on the ward, he reported symptoms of rigors, myalgia and general malaise but remained pain free, with physical examination of the chest and abdomen unremarkable. His vital signs revealed a heart rate of 120 beats per minute, blood pressure 79/58 mm Hg, temperature 39.1°C, respiratory rate 24 and oxygen saturation 84% on room air. Peripheral blood cultures were taken and the patient commenced on high-flow oxygen, broad-spectrum antibiotics and intravenous fluids, being treated for sepsis of unclear origin. Despite 2 L of rapid intravenous crystalloid resuscitation, his systolic blood pressure remained around 80 mm Hg.

Initial blood tests showed, among others, a white cell count of 3.5×10^9 cells/L (94% neutrophils), C reactive protein of 113 mg/L, haemoglobin of 11.8 g/dL, bilirubin of 35 μ mol/L and albumin of 29 g/L, and dipstick urinalysis was negative. He underwent an urgent CT scan of the chest, abdomen and pelvis, before admission to the intensive care unit for septic shock and commenced on vasopressors. The scan revealed an unremarkable chest with a suggestion of a small collection of fluid and gas surrounding the rectal stump; however, there was uncertainty as to whether this was a normal finding postoperatively or indeed an infective complication; the collection was of insufficient volume such that it was not suitable for radiological drainage. Consequently, the patient was closely observed and continued on antibiotic therapy, initially with intravenous co-amoxiclav, metronidazole and gentamicin.

Despite 24 hours of conservative management, the patient remained cardiovascularly unstable and underwent further investigation via proctoscopy. This noted a release of gas and brown fluid from the scope and visible necrotic rectal stump mucosa. Blood cultures subsequently returned positive for *Clostridium perfringens*.

He was treated conservatively for a further 24 hours for a presumed rectal stump collection but clinically deteriorated with increasing vasopressor requirements. A repeat CT scan of the chest, abdomen and pelvis (figure 1) revealed a larger pelvic collection measuring 10.0 cm x 3.7 cm, separate to the rectal stump, that was missed on the original CT scan. He underwent a laparotomy and washout for the collection, with no evidence of bowel ischaemia or perforation identified intraoperatively.

Culture sensitivities showed the organism was fully sensitive to co-amoxiclav, ciprofloxacin and gentamicin and so antibiotic therapy was rationalised to co-amoxiclav monotherapy. The patient made a good clinical recovery, being discharged home 7 days following his relaparotomy, completing a week-long course of antibiotics, and back to his original baseline mobility.

DISCUSSION

Literature review

Based on this unusual postoperative presentation, we undertook a literature search to identify any further cases of *C. perfringens* infection following

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To cite: Bath M, McKelvie M, Canna K. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-221980

Figure 1 CT imaging (axial and coronal views) demonstrating the large pelvic collection (arrows).

abdominal surgery. Using the Medline and Web of Science databases, and Grey Literature Report database for unpublished work, we searched the literature using the search term ‘*Clostridium perfringens*’ and further limited this search by linking the terms (‘Postoperative Complications’ OR ‘Postoperative Infection’) OR (‘Intra-abdominal Sepsis’ OR ‘Intra-abdominal Infections’) via use of an ‘AND’ statement. Searches included all articles up to 14 July 2017, and any duplicates were subsequently removed. Inclusion criteria were English language, patient age >18 years, studies published since 1980 and the infection developing/the patient presenting within 30 days following their primary operation.

Ninety-seven articles were identified through the initial literature search, with one further article identified through additional sources (figure 2). Following removal of duplicates and review of the abstracts, 10 articles were included for the full-text search, from which six were included in the final summary table

(table 1); three of the full-text review articles were rejected as no surgical intervention had been performed prior to their infection being identified^{7–9} and one was rejected as the patient developed the infection more than 30 days postoperatively.¹⁰

Of the six studies included,^{5 6 11–14} none reported cases primarily affecting the gastrointestinal tract. All received intravenous antibiotic therapy for management and four underwent surgical intervention (with one additional case undergoing radiological-guided drainage). Time before presentation of the infection and the source of the infection varied across all cases. Of the six cases, four patients were discharged and two patients died during their admission.

DISCUSSION

We report the unusual case of a *C. perfringens*-induced septic shock following an elective resection of a rectal cancer. While several other cases have previously documented *C. perfringens* infections following abdominal surgery, we believe this is the first documented case of the infection developing following surgery on the gastrointestinal tract.

C. perfringens is a ubiquitous organism of the gastrointestinal tract and the environmental flora, yet is associated with a variety of pathological infections. Indeed, complications from Clostridial infection can cause significant systemic involvement, including haemolysis, renal dysfunction and disseminated intravascular coagulation.

Two main gastrointestinal syndromes mediated by *C. perfringens* have been described, dependent on the specific toxin produced.¹⁵ The alpha-toxin subtype is most typically associated with food poisoning, causing cramping and diarrhoea within 8 to 22 hours of ingestion, while the beta-toxin is characterised by gas formation within gangrenous tissue, rapid progression of infection and abrupt clinical deterioration.¹⁵

This rapid deterioration of the patient was a key feature of our case. Interestingly, many of the reports from our literature review also document a similar rapid decline in a previously well patient, despite the varying timings of onset postoperatively. *C. perfringens* is well known to develop in areas of contaminated muscle injury or following abdominal surgery,⁸ so it could be argued that the neoadjuvant radiotherapy given to the patient could have damaged the affected area sufficiently to predispose

Figure 2 PRISMA flow diagram of the literature search.

Table 1 Summary of articles included in literature review

Author, year	Patient details	Operation	Time post-op before presentation	Infection source	Intervention	Outcome
Bätge B, 1992 ⁶	61-year-old man; PMH T1DM, previous MI, TB, pancreatic Ca	Modified Whipple procedure	11 days	Multiple liver abscess	Intravenous antibiotics (cefotaxime, piperacillin and metronidazole) and US-guided and CT-guided drainage of abscesses	Discharged (no documented time length)
Halawa S, 2008 ¹¹	44-year-old woman, no documented PMH	Endometrial ablation	18 hours	Uterine	Laparotomy for hysterectomy	Discharged 5 days post-op
Mariona FG, 1980 ¹²	18-year-old woman; primigravida, no documented PMH	Caesarean section	18 hours	Uterine and tubo-ovarian	Intravenous antibiotics (penicillin and clindamycin) and laparotomy for washout and TAH-BSO	Discharged 23 days post-op
Mihaylov P, 2016 ¹³	50-year-old man; PMH ESRD from HTN and FSGS	Living-donor kidney transplantation	25 days	Transplanted kidney	Intravenous antibiotics (metronidazole)	Died 48 hours post-op
Qandeel H, 2012 ¹⁴	59-year-old man; PMH T2DM, previous ERCP for gallstone pancreatitis	Laparoscopic cholecystectomy	1 week	Collection in gallbladder fossa	Intravenous antibiotics (piperacillin, gentamicin, metronidazole) and laparotomy for washout	Developed persistent renal dysfunction post-op, underwent dialysis Developed haemothorax post-heparin infusion for dialysis Discharged 2 months post-op
Takazawa T, 2016 ⁵	65-year-old woman; PMH bladder Ca, previous TAH and right oophorectomy	Radical cystectomy with ileal conduit	16 hours	Necrotising fasciitis (chest and abdominal wall)	Intravenous antibiotics (clindamycin, vancomycin, imipenem) and fasciotomy	Died 38 days post-op

BSO, bilateral salpingo-oophorectomy; ERCP, endoscopic retrograde cholangiopancreatography; ESRD, end-stage renal disease; FSGS, focal segmental glomerulosclerosis; HTN, hypertension; MI, myocardial infarction; PMH, past medical history; TAH, total abdominal hysterectomy; TB, Tuberculosis; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus.

to this infection, this alongside his advanced age. However, given many of the cases, we also reviewed documenting no such discernible risk factors, development of such an infection post-operatively is likely to be multifactorial.

The investigations we undertook following the patient's decline led to the most likely source of infection identified as the rectal stump. Clinical examination and initial imaging showed a clear chest and abdomen; however, the proctoscopy performed when the patient failed to improve with conservative management revealed a markedly necrotic mucosa of the stump and audible evidence of gas passing (produced from the gas-producing bacteria) from the pelvic cavity to the external environment. As no other source was identified postlaparotomy, and with the patient improving following the washout, the rectal stump was deemed the likely infective source.

Most cases of *C. perfringens* will be managed pharmacologically through the use of broad-spectrum antibiotics providing suitable anaerobic cover. Our literature review demonstrated the wide array of combinations that have been previously implemented in its treatment, yet interestingly, a recent review of cases of *C. perfringens* septicaemia with associated haemolysis reported a significant increase in survival with the use of combination antibiotics, specifically penicillin and clindamycin.¹⁶

Moreover, the same review also noted an increase in survival when surgical removal of the infected foci was undertaken.¹⁶ Five of the six cases we identified underwent either surgical or radiological intervention, only one of which was recorded to have died post-intervention. Limited improvement with antibiotic therapy led to our patient requiring surgical intervention through laparotomy with washout, which did also result in clinical resolution.

In summary, *C. perfringens* infections postoperatively are rare but carry a high risk of mortality. They should be considered in all cases of sudden deterioration in a patient who has

previously undergone abdominal surgery. A combination of early broad-spectrum antibiotic therapy, aggressive fluid resuscitation and prompt surgical intervention where appropriate is vital in this patient cohort.

Learning points

- *Clostridium perfringens*, an obligate anaerobe, forms part of both the environmental and gastrointestinal flora. It is most commonly associated with food poisoning, anaerobic cellulitis and gas gangrene.
- Infections arising from *C. perfringens* can rapidly progress into fulminant and fatal sepsis if not treated promptly with antibiotics and/or surgical intervention.
- *C. perfringens* infections postoperatively are rare but carry a high risk of mortality. They should be considered in all cases of sudden deterioration in a patient who has previously undergone abdominal surgery.

Contributors MB and MMK: joint primary authors. Equal contribution towards the manuscript including conception of the work and drafting and revision of the article. KC: critical revision of the article. All authors: final approval of the version to be published.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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