

Inferior epigastric artery pseudoaneurysms

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ABSTRACT

INTRODUCTION Inferior epigastric artery (IEA) pseudoaneurysms are recognised complications of abdominal wall procedures, and a variety of approaches including surgical excision and ligation, percutaneous procedures and conservative management have been employed in treating this rare complication.

METHODS We describe a case of an IEA pseudoaneurysm diagnosed on computed tomography (CT) angiography, 14 days following a laparoscopic assisted low anterior resection, which was managed successfully with surgical excision and ligation. A review of the literature identified 32 reports of this complication since 1973 with 69% of cases occurring since 2000.

FINDINGS The main aetiology of IEA pseudoaneurysm was abdominal surgery ($n=20$); 65% of cases were attributable to abdominal wound closure or laparoscopic surgery. Two-thirds (66%) of patients presented between 11 and 63 days, and all except 1 case presented with discomfort, abdominal mass or haemodynamic instability. Colour Doppler ultrasonography was the imaging modality of choice ($n=18$), either alone or in combination with computed tomography and/or angiography. Surgical ligation and excision and percutaneous coil embolisation formed the mainstay of attempted treatments (69%), particularly following treatment failure using an alternative technique.

CONCLUSIONS The incidence of iatrogenic IEA pseudoaneurysms appears to be increasing. Awareness of this rare complication is of clinical importance to avoid excessive morbidity for affected individuals.

KEYWORDS

False aneurysm – Epigastric arteries – Postoperative complications

Accepted 6 March 2014

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Formation of an inferior epigastric artery (IEA) pseudoaneurysm is a recognised complication following abdominal wall procedures near to the artery. Since 1973, occasional case reports have been published describing IEA pseudoaneurysms as a result of abdominal wall sutures, laparoscopic ports, surgical drain insertion, therapeutic paracentesis, peritoneal dialysis, femoral vessel catheterisation or even spontaneous occurrence.^{1–50} A variety of approaches to treating this rare event have been described in the literature, including surgical ligation and excision, ultrasonography guided compression, percutaneous thrombin injection, percutaneous coil embolisation or, simply, observation.^{1–50}

Recent observation by the authors of a patient presenting with an IEA pseudoaneurysm, due to abdominal wall sutures following a low anterior resection, prompted an analysis of the current literature. Various case reports have commented on the existing literature but no formal literature review has been conducted since 2006, when 16 cases of IEA were considered by Georgiadis *et al.*¹⁷ Our review therefore aims to analyse systematically the growing evidence of this rare and frequently initially overlooked complication.

Case History

In April 2013 a 58-year-old man was referred directly from his general practitioner for flexible sigmoidoscopy with a 12-week history of rectal bleeding, abdominal pain and diarrhoea. Endoscopy revealed a 50mm polypoid rectal tumour, which was suggestive of an adenocarcinoma on biopsy. Further investigation with colonoscopy, computed tomography (CT) and magnetic resonance imaging indicated a T3 N1 lesion on the left rectal wall, approximately 11cm from the anal verge. Prior to this diagnosis, he was fit and well, and a keen sportsman. As a result, he was deemed an ideal candidate for a laparoscopic low anterior resection, following a short course of radiotherapy, by the colorectal multidisciplinary team.

The patient's laparoscopic resection was carried out in June 2013. The pelvic dissection was completed via a Pfannenstiel incision owing to the restriction caused by a narrow male pelvis. The specimen was resected and a primary end-to-end anastomosis achieved with an EEA $\text{\textcircled{c}}$ 31mm stapler (Covidien, Dublin, Ireland). A loop ileostomy was formed at

a premarked site in the right flank and there were no concerns on closure of the abdomen.

Four days following the procedure, the patient developed erythema and induration around the transverse wound. The left lateral sutures were cut, resulting in drainage of a small volume of blood stained fluid. The patient was discharged the next day. Eleven days following surgery, he was readmitted following a large bleed at home from the open aspect of his wound. However, he was discharged again within 24 hours as observations and haemoglobin remained stable, and no further bleeding occurred while in the hospital. Two days later, he was readmitted with a further large bleed and his systolic blood pressure was 90mmHg. Urgent CT angiography revealed a 3.5cm pseudoaneurysm of the left IEA in communication with a haematoma (Figs 1 and 2). He underwent urgent surgical ligation and excision later the same day, and was discharged three days later with no further complications.

Methods

A literature search was performed using MEDLINE® (1950 to July 2013) using the terms 'inferior epigastric artery' and 'pseudoaneurysm', 'pseudo-aneurysm' or 'false aneurysm'. The search was repeated on Embase (1980 to July 2013) and PubMed. It was extended to include a review of references from relevant articles as well as a further search on Google Scholar, which identified a further two articles.

The dataset consisted of 19 published case reports, 6 published abstracts of case reports, 2 letters to the editor, 1 conference abstract and 1 set of original data from the authors. Original data for three further cases described in the 2006 review by Georgiadis *et al*¹⁷ could not be sourced. However, comparing the data these authors presented for



Figure 1 Thick maximum intensity projection computed tomography reconstructions: Coronal view (A) at the level of the pubic symphysis. Both right and left inferior epigastric arteries (IEAs) are demonstrated (arrows), with the pseudoaneurysm (asterisk) seen arising from the left IEA. Sagittal view (B) at the level of the left IEA (open arrow) and left external iliac artery (oblique arrow). Surrounded by a haematoma, the pseudoaneurysm (asterisk) arises from the IEA. The overlying skin incision is evident (arrowhead).

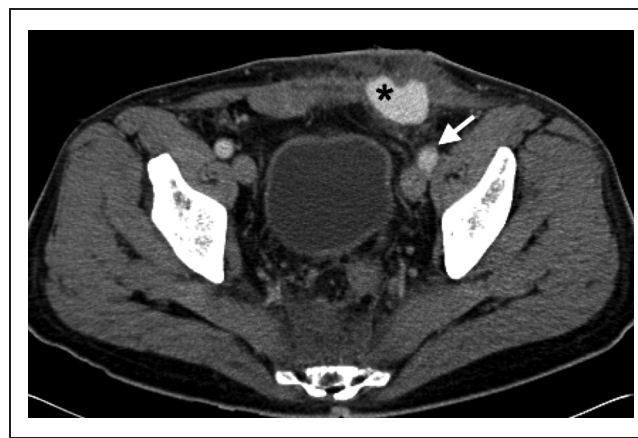


Figure 2 Axial computed tomography at the level of the Pfannenstiel incision. The pseudoaneurysm (asterisk) is evident in the left rectus sheath. Note how the enhancement matches that of the external iliac artery (arrow).

11 other case reports/abstracts with the original published papers did not show any disparities. It was therefore felt safe to quote the figures for these three studies from the paper by Georgiadis *et al*. (One case report reviewed by Georgiadis *et al* was excluded from our review as the abstract suggested a spontaneous rectus sheath haematoma rather than an IEA pseudoaneurysm.) Data regarding the aetiology, time until diagnosis, presenting symptoms/signs, imaging modalities used, pseudoaneurysm size, treatments, complications and patient outcome were collected where available (Appendix 1 – available online).

Findings

IEA pseudoaneurysms remain a rare event, with 32 cases reported in the international literature over the last 40 years. Abdominal surgery resulted in 20 out of these 32 IEA pseudoaneurysms. Abdominal wound closure and laparoscopic procedures attributed to 65% of these cases. Sporadic cases of an IEA pseudoaneurysm following therapeutic paracentesis of ascites, percutaneous vascular procedures, trauma or arising spontaneously continue to occur. Only one published case of an IEA pseudoaneurysm following Tenckhoff catheter removal exists (Table 1).

One case of IEA pseudoaneurysm was an incidental finding whereas all other pseudoaneurysms presented with signs and symptoms ranging from localised discomfort to tender pulsatile masses to haemodynamic instability. Information regarding time to presentation was available for 27 cases and demonstrated that 33% received a diagnosis within 72 hours of the causative factor. The remainder were diagnosed between 11 and 65 days. A case of four years from suspected trauma to diagnosis was presented in the literature but the patient was only symptomatic for 28 days prior to diagnosis and may have experienced a spontaneous pseudoaneurysm so this case was excluded. The overall mean time to diagnosis was therefore 21 days.

Table 1 Cause of inferior epigastric artery (IEA) pseudoaneurysm

| Aetiology | n |
|-------------------------------------|----|
| Abdominal surgery | 20 |
| Abdominal wound closure | 8 |
| Laparoscopic procedure | 5 |
| Surgical drain insertion | 3 |
| Abdominal wall debridement | 1 |
| Ileostomy formation | 1 |
| Repair of iatrogenic IEA laceration | 1 |
| Open hernia repair | 1 |
| Therapeutic paracentesis | 4 |
| Percutaneous vascular procedures | 3 |
| Spontaneous | 3 |
| Tenckhoff catheter removal | 1 |
| Trauma | 1 |

Table 2 Imaging used to diagnose inferior epigastric artery pseudoaneurysm

| Imaging modality | n |
|-----------------------------------------------------|---|
| Ultrasonography | 8 |
| Computed tomography | 2 |
| Angiography | 4 |
| Ultrasonography + computed tomography | 7 |
| Computed tomography + angiography | 5 |
| Ultrasonography + computed tomography + angiography | 3 |
| Endoscopy | 1 |
| Unknown | 2 |

There was no definitive imaging modality of choice identified. Instead, a variety of colour Doppler ultrasonography, contrast enhanced CT or angiography was used, either alone or in combination (Table 2). However, 56% of patients were investigated with ultrasonography. Where there is reasonable clinical suspicion of pseudoaneurysm formation, this is the recommended first-line investigation. The technique is readily available, sensitive in experienced hands and free from radiation. Information regarding the size of pseudoaneurysm was only available for 19 of the 32 cases. The size ranged from 0.3cm to 10cm. The four largest pseudoaneurysms (ranging from 6cm to 10cm) were all treated successfully with percutaneous coil embolisation.

The mainstay of IEA pseudoaneurysm treatment consists of surgical ligation and excision or percutaneous coil

Table 3 Treatment of inferior epigastric artery pseudoaneurysm

| Treatment modality | Total | Failure rate |
|------------------------------------|-------|--------------|
| Surgical ligation + excision | 13 | 0 |
| Percutaneous coil embolisation | 11 | 0 |
| Percutaneous thrombin injection | 4 | 0.25 |
| Observation | 4 | 0.5 |
| Gelfoam® | 1 | 0 |
| N-butyl cyanoacrylate | 1 | 0 |
| Ultrasonography guided compression | 1 | 0 |

embolisation, representing 69% of treatments attempted (Table 3). In particular, in cases of treatment failure following observation or percutaneous thrombin injection, treatment was only reattempted using surgical measures or coil embolisation (3 cases).

Discussion

The IEA branches from the external iliac and courses along the posterior wall of the rectus sheath between 4cm and 8cm from the midline.⁵¹ Any procedures penetrating the abdominal wall can therefore risk injury to the IEA. Although IEA pseudoaneurysms remain a rare event, the rate of incidence appears to be increasing gradually, with 69% of the 32 known cases from the last 40 years presenting since 2000.

A review of the existing international literature has shown that the most common cause of an IEA pseudoaneurysm is damage to the IEA during abdominal wound closure or during laparoscopic procedures. Perhaps owing to the variation in presenting symptoms and difficulty in distinguishing the problem from a simple postoperative haematoma, the average time from causative procedure to diagnosis is 21 days.

The small size of the study group prevents any conclusions to be drawn regarding treatment recommendations for IEA pseudoaneurysms. With the increased rates of arterial catheterisation procedures, multiple studies have considered the investigation and treatment of femoral artery pseudoaneurysms. As a result, recommendations from this literature can be used to inform clinical decisions in IEA pseudoaneurysm management.

Recent measures including transillumination to aid port insertion under direct vision have been adopted to reduce reports of up to 2% of laparoscopic surgeries being complicated by trauma to abdominal wall vessels.⁵¹ However, the inferior epigastric vessels can only be identified in 82% of cases, with poor visualisation resulting from increased body habitus.⁵²

Conclusions

Awareness of IEA pseudoaneurysm occurrence is clinically relevant, with both increasing trends towards laparoscopic

surgery and increasing obesity rates. Furthermore, presentation is often delayed by a number of weeks and the diagnosis is easily confused with a simple postoperative haematoma so awareness among specialists and general medical practitioners is beneficial to avoid increased patient morbidity following an abdominal wall procedure.

References

1. Ello FV, Nunn DB. False aneurysm of the inferior epigastric artery as a complication of abdominal retention sutures. *Surgery* 1973; **74**: 460–461.
2. Gage TS, Sussman SK, Conard FU *et al.* Pseudoaneurysm of the inferior epigastric artery: diagnosis and percutaneous treatment. *Am J Roentgenol* 1990; **155**: 529–530.
3. Segev Y, Orron D, Alon R, Graif M. Pseudoaneurysm of the inferior epigastric artery mimicking abdominal wall hematoma. *J Ultrasound Med* 1994; **13**: 483–484.
4. Ferrer JV, Soriano P, Zazpe C *et al.* Pseudoaneurysm of the inferior epigastric artery. Pathogenesis, diagnosis, and treatment. *Arch Surg* 1996; **131**: 102–103.
5. Verbist J, Stillaert F, Dujardin P, Dewaele G. Pseudoaneurysm of the inferior epigastric artery. *Acta Chir Belg* 1997; **97**: 196–198.
6. Lam EY, McLafferty RB, Taylor LM *et al.* Inferior epigastric artery pseudoaneurysm: a complication of paracentesis. *J Vasc Surg* 1998; **28**: 566–569.
7. Macfarlane MP, Cast JE, Ettles DF. Percutaneous coil embolization of an inferior epigastric pseudoaneurysm. *J Intervent Radiol* 1998; **13**: 111–114.
8. Werner M, Bernheim J, Witz M *et al.* Pseudoaneurysm of the inferior epigastric artery – a rare complication of Tenckhoff catheter removal. *Nephrol Dial Transplant* 1999; **14**: 1,297–1,299.
9. Wutke R, Reck T, Bantz W. Pseudoaneurysm of the A. epigastrica inferior after laparoscopic cholecystectomy. *Rofo* 1999; **171**: 494–496.
10. Shabani AG, Baxter GM. Inferior epigastric artery pseudoaneurysm: ultrasound diagnosis and treatment with percutaneous thrombin. *Br J Radiol* 2002; **75**: 689–691.
11. Murthy SV, Hussain ST, Gupta S *et al.* Pseudoaneurysm of inferior epigastric artery following abdominal paracentesis. *Indian J Gastroenterol* 2002; **21**: 197–198.
12. Piñero A, Reus M, Agea B *et al.* Case report: Conservative management of an arteriovenous fistula of the inferior epigastric artery. *Br J Radiol* 2003; **76**: 135–136.
13. Bennett JD. Evidence-based radiology problems. Inferior epigastric artery pseudoaneurysm: computed tomographic diagnosis and transcatheter therapy. February 2004 – January 2005. *Can Assoc Radiol J* 2004; **55**: 8–11.
14. Takase K, Kazama T, Abe K *et al.* Pseudoaneurysm of the inferior epigastric artery successfully treated by ultrasound-guided compression. *Cardiovasc Intervent Radiol* 2004; **27**: 520–522.
15. Rege SA, Hanchate V, Rohondia O. Pseudoaneurysm of the inferior epigastric artery: a rare complication of abdominal wall suturing. *Internet J Surg* 2005; **6**(1).
16. Karimian F, Darbianian K, Paydar A. Pseudoaneurysm of inferior epigastric artery complicating ileostomy construction. *Singapore Med J* 2006; **47**: 910–912.
17. Georgiadis GS, Souftas VD, Papas TT *et al.* Inferior epigastric artery false aneurysms: review of the literature and case report. *Eur J Vasc Endovasc Surg* 2007; **33**: 182–186.
18. Park SW, Choe WH, Lee CH *et al.* Transcatheter embolization of a pseudoaneurysm of the inferior epigastric artery with N-butyl cyanoacrylate. *Br J Radiol* 2008; **81**: e64–e67.
19. Ruiz-Tovar J, Rubio M, Conde S *et al.* Inferior epigastric artery pseudoaneurysm: complication of surgical drain insertion. *ANZ J Surg* 2008; **78**: 1,139.
20. Krokidis M, Hatzidakis A, Petrakis J *et al.* Coil embolization of inferior epigastric artery pseudoaneurysm after percutaneous thrombin injection failure: a case report. *Cases J* 2009; **2**: 6562.
21. Bildzukewicz NA, Durkan B, Maxwell PJ, Isenberg GA. A pseudoaneurysm of the inferior epigastric artery after laparoscopic right hemicolectomy. *Am Surg* 2009; **75**: 1,266–1,268.
22. Kim JM, Jun NH, Kim HK, Min KT. Pseudoaneurysm in the inferior epigastric artery and scrotal hematoma following removal of a femoral vein catheter. *Korean J Anesthesiol* 2010; **59 Suppl**: S3–S5.
23. Venkatesh SK, Reynolds VB, Raj Sidhu H, Maran PK. Spontaneous inferior epigastric artery pseudoaneurysm. *J Clin Ultrasound* 2010; **38**: 259–262.
24. Parnaby CN, Nicholls D, Docherty JG. Inferior epigastric artery false aneurysm following incisional hernia repair. *Int J Surg Case Rep* 2011; **2**: 178–180.
25. Splinter KL, Cook CL. Inferior epigastric artery pseudoaneurysm following trocar injury. *J Minim Invasive Gynecol* 2012; **19**: 393–395.
26. Carr WR, Mohamed ZK, Cundall J. Rupture of an inferior epigastric artery pseudo-aneurysm following laparoscopic port insertion. *BMJ Case Rep* 2012; bcr0220125867.
27. Williamson JS, Harries RL, Davies G, Woodward A. Spontaneous resolution of an inferior epigastric artery pseudoaneurysm secondary to surgical drain placement. *Ann R Coll Surg Engl* 2012; **94**: e193–e194.
28. Nichols-Totten K, Pollema T, Moncure M. Pseudoaneurysm of the inferior epigastric artery: a rare complication of laparoscopic ventral hernia repair. *Surg Laparosc Endosc Percutan Tech* 2012; **22**: e25–e27.
29. Duttlinger A, Jeschke R, Javaheri S. A novel approach to the management of a retroperitoneal hemorrhage: the importance of the inferior epigastric artery. *Catheter Cardiovasc Interv* 2013; **81**: S165–S166.
30. Tozzi M, Molteni M, Franchin M *et al.* Inferior epigastric artery pseudoaneurysm in a kidney transplant recipient. *Case Rep Transplant* 2013; 459320.
31. Saber AA, Meslemani AM, Davis R, Pimentel R. Safety zones for anterior abdominal wall entry during laparoscopy: a CT scan mapping of epigastric vessels. *Ann Surg* 2004; **239**: 182–185.
32. Hurd WW, Amesse LS, Gruber JS *et al.* Visualization of the epigastric vessels and bladder before laparoscopic trocar placement. *Fertil Steril* 2003; **80**: 209–212.