Scientific Research Publishing

Case Reports in Clinical Medicine, 2025, 14(6), 303-311
https://www.scirp.org/journal/crcm
ISSN Online: 2325-7083
ISSN Print: 2325-7075

Iatrogenic Bladder Injury during Emergency Laparoscopic Appendicectomy: A Case Report, Diagnosis, Management, and Literature Review with Lessons to Be Learned by the Surgical Trainee

Mohammed A. Salam AL-Qadri, Mohamed Al-Masruri, Naama AL Badowi, Hamidreza Shemshaki, Qais Al-Hoti

Department of General Surgery and Urology, Royal Hospital Muscat, Muscat, Oman
Email: hammmod4444@gmail.com

How to cite this paper: AL-Qadri, M.A.S., Al-Masruri, M., AL Badowi, N., Shemshaki, H. and Al-Hoti, Q. (2025) Iatrogenic Bladder Injury during Emergency Laparoscopic Appendicectomy: A Case Report, Diagnosis, Management, and Literature Review with Lessons to Be Learned by the Surgical Trainee. *Case Reports in Clinical Medicine*, **14**, 303-311.
https://doi.org/10.4236/crcm.2025.146040

Received: April 28, 2025
Accepted: June 27, 2025
Published: June 30, 2025

Abstract

Laparoscopic appendicectomy is a gold standard procedure for acute appendicitis in the modern era. Iatrogenic injuries are well-recognized during any laparoscopic surgical procedure. The incidence of organ-specific and procedure-specific injuries is not well described and is under-reported. Here we describe a case of incidental bladder injury that was not recognized intraoperatively and yet was managed successfully with conservative management. The literature was reviewed and learning points were highlighted.

Keywords

Appendicitis, Bladder Injury, Creatinine Level, Conservative Management, Extraperitoneal

1. Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide. The gold standard treatment of acute appendicitis is appendicectomy, which has been performed laparoscopically since the introduction and development of this approach in the early 1980s. The advantages of laparoscopy over the open procedure are limited invasiveness, lower complications, early discharge, less analgesia, lower cost, fast recovery, and early patient return to work [1]-[4].

Although the laparoscopic appendicectomy is a safe procedure, early and delayed

complications have been reported in the literature which include inadvertent injuries to the viscera either with the insertion of the trocar or during anatomical dissection, bleeding, conversion to open, wound infection and incisional or port site hernias. The standard laparoscopic appendicectomy involves three port incisions, around the umbilicus, suprapubic area, and in the left iliac fossa. Isolated trocar injuries to the bladder have been described in the literature with variable management of the cases ranging from conservative to invasive surgical procedures (Table 1).

Here we describe a case of laparoscopic appendicectomy in which an inadvertent bladder injury was managed successfully with conservative management. The literature about isolated bladder injury during laparoscopic appendicectomy was reviewed.

2. Case Summary

A 13-year-old male patient was admitted under acute surgical service with a three-day history of progressive abdominal pain. The pain started at the epigastric area and then shifted to the lower abdomen with fever, anorexia, and vomiting of food particles four times. He reported a normal bowel habit but had difficulty in urination in the last three days because of the abdominal pain. He did not report any chest pain, dizziness, headache, seizures, or any neurological manifestations. His past medical history was not relevant and he did not have any known drug or food allergies. On admission, his vital signs were normal: a body temperature of 36.8 Celsius, HR: 105/min, Respiratory rate of 18 breaths per minute, BP:107/66, and Spo2: 99%. His Abdominal examination revealed voluntary guarding all over with marked right iliac fossa tenderness and a positive rebound sign. Laboratory investigations showed high inflammatory markers with a White Blood Cell count (WBC) of 17.8 and C-reactive protein (CRP) of 227. His other investigations were within normal limits, including urea electrolyte, liver function, serum amylase, arterial blood gas, and coagulation profile. He was admitted to the surgical floor with a diagnosis of complicated appendicitis. He was resuscitated with intravenous fluids, analgesics (Intravenous (IV) paracetamol), antiemetics(metoclopramide), and IV antibiotics (cefuroxime 1.5 g TID and Metronidazole 500 mg TID). A Foley's catheter was inserted, which was draining clear urine. A CT abdomen with IV and oral contrast was done to rule out any appendicular mass or abscess. The CT abdomen reported a dilated, fluid-filled appendicular lumen measuring about 1.4 cm in diameter with no evidence of air or contrast within the lumen. The appendicular wall was thickened with significant surrounding inflammatory changes and fat strandings. Few hyperdense foci were noted within the lumen, the largest seen near the base measuring about 0.4 cm, suggestive of an appendicolith and a thinning of the appendicular wall (Figure 1). No evidence of periappendicular abscess mass formation or pneumoperitoneum was noted. The surrounding ileocecal valve and terminal ileum showed reactive wall thickening secondary to local inflammatory changes. Multiple dilated fluid-filled small bowel loops including ileum were present reaching a maximum diameter of 3.4 cm. No evidence of a transition point was seen. The oral contrast was noted in mid-ileal loop representing a paralytic ileus secondary to the inflammatory process. Minimal free fluid was noted in subhepatic

space. The urinary bladder was partially collapsed with air within the lumen secondary to foleys catheter. In summary, all those features above were suggestive of a severely inflamed appendix, with tiny focal perforation at the wall, with local inflammatory changes extending to the ileocecal valve and terminal ileum with no evidence of peri-appendicular abscess or mass formation. Multiple dilated small bowel loops including ileal loops mainly with no transition point likely represent features of paralytic ileus secondary to a local inflammatory process.

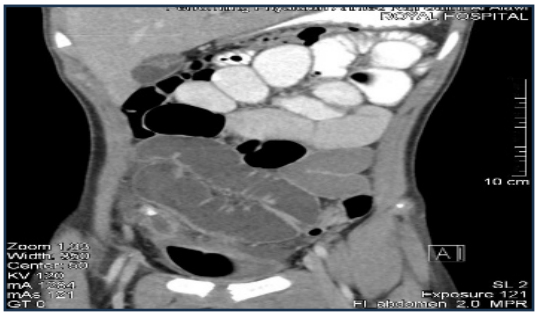

Figure 1. CT abdomen showing features of appendicitis.

The patient underwent a laparoscopic appendectomy which was performed by the surgical trainee supervised by the senior registrar in the late morning hours (12.10 p.m till 13.35 p.m). The classical 3 ports were inserted, 10 mm infra-umbilical, 10 mm left lumbar, and 5mm suprapubic. Intraoperative findings consisted of free turbulent fluid with an inflamed appendix with perforation at its tip; otherwise, no perforation at the base of the cecum. Irrigation, and suction followed by routine appendicectomy were done after ligating the base with an Endo loop. The appendix was delivered through an Endo bag, final irrigation was done and an abdominal drain was inserted through the suprapubic catheter before its removal. Post-operatively on Day 0 a high drain output was noted. Initially, 1liter over the first 5hrs was blood-stained, and then 400 ml of serous fluid was added. He was kept on ringer lactate replacement 1:1. On Day 1 patient was in mild pain, drain output was 1.5 L (**Figure 2**) while his Foley catheter was still draining clear urine. The Foley catheter was removed the abdominal drain was kept and the patient was allowed to take a diet and was encouraged to mobilize. On Day 3 post-op, the patient was

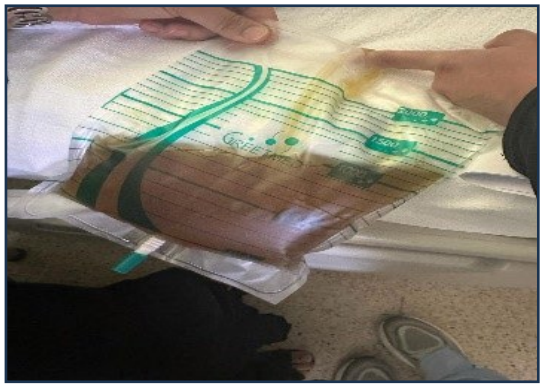

Figure 2. Drain output showing urine colour.

vitally stable, was mobilizing and tolerating his diet, and had improved his inflammatory markers; however, his urine output was 4.3 L/24 hrs. Drain output was 1liter and was serous in colour, urine creatinine was sent and showed a 5000-creatinine level.

Patient antibiotics were changed from cefuroxime to Augmentin. A bladder injury was suspected and the patient was referred urgently to the urological service. A Foley catheter was reinserted as per urological advice. A CT-cystogram was requested, and a drain tube was noted to be piercing the bladder through and through and going out superiorly, with a tip seen at the subhepatic area (**Figure 3**).

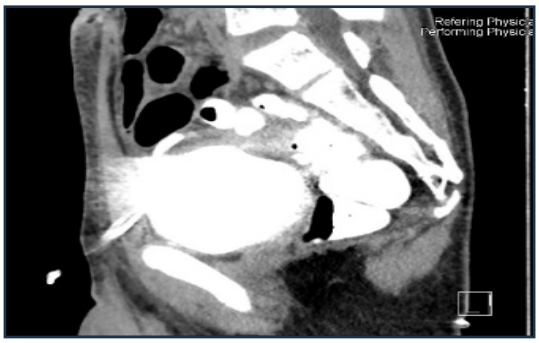

Figure 3. CT cystogram showing bladder dome perforation.

The initial discussion and decision with the urological team was to counsel the patient for diagnostic laparoscopy and possible laparoscopic/open surgical bladder repair. However, after further discussion, it was decided to give conservative management a chance and to consider surgical intervention only if the conservative approach fails. After reinsertion of the foley catheter, the abdominal drain output progressively decreased and became nil which was confirmed with a follow-up ultrasound of the abdomen which did not report any free fluid in the abdominal cavity on Day 5, hence the drain was removed and the patient was allowed to go home with indwelling foley catheter for 14 days and to have follow up cystogram as an outpatient. A Cystogram after 2 weeks showed intact bladder mucosa with no leakage of contrast (**Figure 4**) and hence, the Foley catheter was removed.

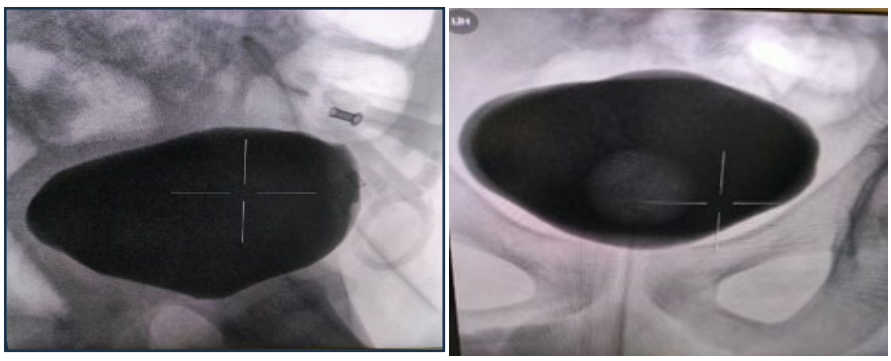

Figure 4. Cystogram performed on post-operative day 14 with urinary catheter in situ. Images show normal opacification of the urinary bladder with no evidence of any leak.

On a follow-up telemedicine appointment, the patient reported doing fine, with no complaints and normal voiding. He was discharged from the clinic with advice to report to a local health center if he suffers from any abdominal pain or voiding difficulty.

3. Discussion

Laparoscopic appendectomy is considered one of the most common emergency surgeries performed globally since it was first introduced in the early 1980s as it is associated with lower complications and faster recovery compared to open appendicectomy [1]-[4]. Usually, it is one of the first surgeries a surgical trainee can perform. It is usually a safe procedure; however, studies have shown that complications are higher when a surgical trainee carries out the procedure. The seniority of the operating surgical trainee was inversely associated with longer operating time of the surgery and higher complication rates [5] [6]. The complication rate ranges between 6.71% - 12.7%, and these complications include surgical site infection, deep wound infection, and intrabdominal bleeding or visceral organ injuries [6] [7].

Incidental bladder injury during the laparoscopy does occur and is considered a rare complication with an occurrence range of 0.17 to 0.36% in adult general surgery cases [8]-[10]. This may depend on the surgeon's experience, patient anatomy, previous abdominal or pelvic surgery, and inflammatory conditions. Other various reasons may include inadvertent thermal injury from electrosurgical instruments, trocar insertion, dissection in the presence of adhesions, or distorted or congenital anomalies such as patent urachus. Another factor could be incomplete voiding of urine before surgery due to pain or bladder irritation secondary to appendicitis, preexisting bladder outlet obstruction, or bladder hypotony (detrusor weakness). According to the study by Joshoua Rae *et al.*, the risk of laparoscopic bladder injury in the pediatric age group was reported to be 0.73% [11], probably relating to the small size of the abdominal cavity and the presence of a greater proportion of the full bladder within the abdominal cavity compared to the adults.

Usually, the bladder injury is diagnosed intra-operatively as macroscopic haematuria, a visible hole in the bladder, a visible catheter, clear fluid in the intraoperative field, or gaseous distension of a catheter bag during the laparoscopic procedure. In suspicious cases, a dilute methylene blue or normal saline flushed through the urethral catheter may assist in identifying the injury and infrequently, an on-table cystogram may be necessary to establish the diagnosis. If diagnosed intraoperatively, the injuries should be repaired laparoscopically if expertise is available or an open surgical repair should be performed. However, in many reported series of cases the diagnosis was delayed, ranging from 24 hrs post-op to a few days when patients were diagnosed either due to abdominal pain related to urinary peritonitis, intraperitoneal hemorrhage, oliguria, or high abdominal drain output [7]-[10]. If a bladder injury is discovered postoperatively, several patient factors will determine if or when bladder repair should be performed. In general, both blunt and pene-

trating ureteric and bladder injuries require urological management. Iatrogenic bladder injuries not only happen during port positioning during laparoscopic appendicectomy but can also happen during pelvic and endoscopic surgery and catheter placement. Approximately, 60% of bladder injuries are extraperitoneal, 30% are intraperitoneal, and the remaining 10% are both extra and intraperitoneal [12]. Most bladder injuries are diagnosed on the spot intraperitoneally or later radiologically with an abdominal ultrasound or contrast CT scan. According to British Association of Urology Surgeons (BAUS) 2021 guidelines, a level 1 recommendation indicates that if there is a high index of suspicion of bladder trauma, the diagnosis must be confirmed with a contrast-enhanced CT scan [13]. The injury must be classified as extraperitoneal or intraperitoneal. If there is no visible contrast leak but an index of suspicion remains due to symptoms of pelvic pain, retention, anuria, or haematuria, then a formal CT cystogram or a fluoroscopic cystogram (typically 200 - 300 mL dilute contrast medium) should be performed.

The management of extraperitoneal bladder injury as per BAUS recommendation is initially conservative with urethral catheterization alone, as most of these injuries heal in 2 - 3 weeks. However, an open repair should be considered if the injury is major or the catheter does not stay in the bladder. A cystogram should be performed before catheter removal. An intraperitoneal or mixed bladder injury ultimately needs surgical intervention. With the advancement in surgical approaches, laparoscopic or robot-assisted repair can be attempted if such expertise is available, but it should not delay managing a deteriorating patient. Importantly, an open repair will require a lower midline or a Pfannenstiel laparotomy with adequate exposure, examination of the whole bladder, debridement up to clean edges, and mobilization from its attachments for a tension-free closure with absorbable sutures in two layers in a continuous or interrupted fashion with interposition of the omentum. A urethral and a suprapubic catheter should be inserted as a urethral catheter can be blocked or fall out. Exceptionally, a small intraperitoneal injury in a stable patient can also be treated conservatively with good urinary drainage (Urethral catheterization ± abdominal drain), antibiotics, and close patient observation. Repeatedly, a cystogram should be performed before any catheter removal, ensuring complete healing of the bladder injury.

In our patient, though initial assessment and diagnosis were confirmed with a CT cystogram and an initial plan was in favor of a laparoscopic/open surgical repair, a conservative approach was finally preferred with a urinary catheter reinsertion, close observation, antibiotics, and follow up abdominal ultrasound for monitoring of free intraperitoneal fluid, and it was successful. To minimize the risk of bladder injury during laparoscopic appendectomy, some surgeons ask their patients to void before surgery. However, this method is inadequate as the patients in pain may be unable to empty their bladder fully. Another method is temporary 'in-out' urinary catheterization, but in 2 case reports, this strategy ended up with bladder injury, as the bladder had enough time to re-fill during surgery [14] [15]. An on-table catheterization appears to be a better strategy likely to prevent or reduce the risk of bladder injury during laparoscopic appendectomy compared to

the two former methods. However, this will not give complete prevention as many other factors affect the risk of bladder injury, such as surgeon experience, history of previous abdominal surgeries, and pediatrics, which have a comparatively smaller operative field.

In our case, the patient had a Foley catheter during the surgery, and still, he got a bladder injury. Table 1 shows a literature review of different cases of bladder injury, the management performed in each case, and the clinical outcome.

Table 1. Showing a literature review of different cases of bladder injury with management done in each case.

Study	Age	Sex	Pre-surgery catheter insertion	Mechanism of bladder injury	Time of bladder injury recognition	Management	Clinical outcome
J. Xavier *et al.* (2022) [8]	13	F	No	Difficulty in inserting the suprapubic port, with multiple passes and counter tension required	On post-operative day one	18Fr IDC was inserted for 7 days with antifungal due to fever and positive urine culture	A repeat cystogram was performed seven days later, which showed no ongoing urine leak
Levy *et al.* (2012) [9]	27	F	Yes	Diagnostic laparoscopy (performed by a registrar) for lower abdominal pain	three days after surgery	Treated conservatively by urinary catheterization	Recovered without sequelae
R. Guanà *et al.* (2020) [15]	11	M	Yes	Bladed 5-mm port was inserted in the suprapubic region, just slightly to the left of the midline. Abdominal drain was kept in the same port site after surgery	On post-operative day 1 after catheter removal	The drain was removed and a transurethral Catheter was placed for 7 days	On day 7 both the abdominal US and the cystogram were repeated, revealing a complete resolution of the leakage
Lad *et al.* (2013) [16]	35	F	"In-out" urinary catheterization	10 mm port was placed in the midline suprapubic region	Two days after surgery	urinary catheterization for 6 days, intravenous Tazocin and Teicoplanin for 4 days	CT cystogram was conducted, which showed no evidence of Contrast leak after 6 days
Zigiotto *et al.* (2023) [17]	9	M		5-mm suprapubic cannula placed in the usual midline position	post-operative hours	Indwelling Foley catheter was kept for 10 days, intravenous piperacillin/tazobactam	successful closure of both defects documented by the subsequent CT scan

4. Conclusions

Although bladder injury during laparoscopic appendectomy is considered a rare complication, it has the potential for considerable patient morbidity. Surgeons need to be aware of the risk factors for bladder injury, be vigilant during the surgical procedure, and promptly diagnose and manage bladder injuries when they occur. Therefore, we are recommending the following:

1. Surgical trainees should be supervised during the surgery until they are confident enough to master the procedure.

2. Inserting the urinary catheter at the start of the surgery and keeping it throughout the surgery and not just asking the patient to void before the surgery or in-

serting in-out catheterization.

3. Laparoscopic examination of intra-abdominal organs immediately after inserting the Trocars and on withdrawal of the ports at the end of surgery.

4. Postoperatively a bladder injury is suspected when there is high drain output with macroscopic haematuria or oliguria and the diagnosis can be confirmed with a CT urography or Cystogram.

5. Small intraperitoneal bladder injury can be managed non-operatively by keeping a urethral catheter for 2 weeks and healing should be confirmed with a follow-up cystogram before removal of urinary catheter.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Frazee, R.C., Roberts, J.W., Symmonds, R.E., Snyder, S.K., Hendricks, J.C., Smith, R.W., *et al.* (1994) A Prospective Randomized Trial Comparing Open versus Laparoscopic Appendectomy. *Annals of Surgery*, **219**, 725-731. https://doi.org/10.1097/00000658-199406000-00017

[2] Guller, U., Hervey, S., Purves, H., Muhlbaier, L.H., Peterson, E.D., Eubanks, S., *et al.* (2004) Laparoscopic Versus Open Appendectomy: Outcomes Comparison Based on a Large Administrative Database. *Annals of Surgery*, **239**, 43-52. https://doi.org/10.1097/01.sla.0000103071.35986.c1

[3] Gorter, R.R., Eker, H.H., Gorter-Stam, M.A.W., Abis, G.S.A., Acharya, A., Ankersmit, M., *et al.* (2016) Diagnosis and Management of Acute Appendicitis. EAES Consensus Development Conference 2015. *Surgical Endoscopy*, **30**, 4668-4690. https://doi.org/10.1007/s00464-016-5245-7

[4] Di Saverio, S., Birindelli, A., Kelly, M.D., Catena, F., Weber, D.G., Sartelli, M., *et al.* (2016) WSES Jerusalem Guidelines for Diagnosis and Treatment of Acute Appendicitis. *World Journal of Emergency Surgery*, **11**, Article No. 34. https://doi.org/10.1186/s13017-016-0090-5

[5] Scarborough, J.E., Bennett, K.M. and Pappas, T.N. (2012) Defining the Impact of Resident Participation on Outcomes after Appendectomy. *Annals of Surgery*, **255**, 577-582. https://doi.org/10.1097/sla.0b013e3182468ed9

[6] Walędziak, M., Lasek, A., Wysocki, M., Su, M., Bobowicz, M., Myśliwiec, P., *et al.* (2019) Author Correction: Risk Factors for Serious Morbidity, Prolonged Length of Stay and Hospital Readmission after Laparoscopic Appendectomy—Results from Pol-LA (Polish Laparoscopic Appendectomy) Multicenter Large Cohort Study. *Scientific Reports*, **9**, Article No. 18479. https://doi.org/10.1038/s41598-019-54993-3

[7] Margenthaler, J.A., Longo, W.E., Virgo, K.S., Johnson, F.E., Oprian, C.A., Henderson, W.G., *et al.* (2003) Risk Factors for Adverse Outcomes after the Surgical Treatment of Appendicitis in Adults. *Annals of Surgery*, **238**, 59-66. https://doi.org/10.1097/01.sla.0000074961.50020.f8

[8] Xavier, J., Pham, C.T., Cheah, H., Wong, K. and Di Lernia, S. (2022) Bladder Injury during Laparoscopic Appendectomy: Detection, Management, and Learning Point for Surgical Trainees. *Surgery in Practice and Science*, **9**, Article ID: 100075. https://doi.org/10.1016/j.sipas.2022.100075

[9] Levy, B., De Guara, J., Willson, P., Soon, Y., Kent, A. and Rockall, T. (2012) Bladder

Injuries in Emergency/expedited Laparoscopic Surgery in the Absence of Previous Surgery: A Case Series. *The Annals of the Royal College of Surgeons of England*, **94**, e118-e120. https://doi.org/10.1308/003588412x13171221502149

[10] Nason, G.J., Baig, S.N., Burke, M.J., Aslam, A., Kelly, M.E., Walsh, L.G., *et al.* (2015) On-Table Urethral Catheterisation during Laparoscopic Appendicectomy: Is It Necessary? *Canadian Urological Association Journal*, **9**, 55-58. https://doi.org/10.5489/cuaj.2341

[11] Rae, J., Subramanian, T. and Marven, S. (2022) Iatrogenic Bladder Injury at Pediatric Laparoscopic Appendicectomy: Avoiding the Triangle of Danger. *Journal of Pediatric Endoscopic Surgery*, **4**, 113-116.

[12] Bryk, D.J. and Zhao, L.C. (2015) Guideline of Guidelines: A Review of Urological Trauma Guidelines. *BJU International*, **117**, 226-234. https://doi.org/10.1111/bju.13040

[13] Sahai, A., Ali, A., Barratt, R., Belal, M., Biers, S., Hamid, R., *et al.* (2021) British Association of Urological Surgeons (BAUS) Consensus Document: Management of Bladder and Ureteric Injury. *BJU International*, **128**, 539-547. https://doi.org/10.1111/bju.15404

[14] Hotonu, S.A. and Gopal, M. (2019) Bladder Injury in a Child during Laparoscopic Surgery. *Journal of Surgical Case Reports*, **2019**, rjz043. https://doi.org/10.1093/jscr/rjz043

[15] Guanà, R., Pane, A., Cerchia, E., Garofalo, S., Scottoni, F., Marazzato, D., *et al.* (2020) Bladder Injury during Pediatric Laparoscopic Appendectomy: Diagnosis and Management. *Journal of Pediatric Endoscopic Surgery*, **2**, 221-222. https://doi.org/10.1007/s42804-020-00068-4

[16] Lad, M., Duncan, S. and Patten, D.K. (2013) Occult Bladder Injury after Laparoscopic Appendicectomy. *BMJ Case Reports*, **2013**, bcr2013200430. https://doi.org/10.1136/bcr-2013-200430

[17] Zigiotto, D., Elio, A., Tallarigo, C. and Picassi, S. (2023) Intra/Extraperitoneal Bladder Injury during Laparoscopic Appendectomy: Tips to Prevent an Avoidable Complication. *Journal of Pediatric Surgery*, **58**, 597-598. https://doi.org/10.1016/j.jpedsurg.2022.09.043