Available online at www.sciencedirect.com

ScienceDirect

Journal of the Chinese Medical Association 78 (2015) 283–286

www.jcma-online.com

Original Article

Measurement of peritoneal fluid urea nitrogen and creatinine levels is useful to detect iatrogenic urinary tract leakage in colorectal surgery

Jui-Ho Wang [a], Ya-Hsin Kung [b], Tai-Ming King [a], Min-Chi Chang [a], Chao-Wen Hsu [a,b,*]

[a] *Division of Colorectal Surgery, Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, ROC*
[b] *Faculty of Medicine, National Yang-Ming University, Taipei, Taiwan, ROC*

Received September 2, 2014; accepted November 4, 2014

Abstract

Background: Increased peritoneal drainage after colorectal surgery is a common problem. Measurement of peritoneal fluid urea nitrogen (UN) and creatinine (Cr) is a diagnostic tool to detect the urinary tract leakage (UTL). We evaluated its application in colorectal surgery.
Methods: We conducted a retrospective chart review study. We enrolled patients with iatrogenic UTL, and measured their UN and Cr levels in peritoneal fluid and compared them with those in blood and urine. Meanwhile, we assigned patients without UTL to a control group and compared clinical parameters of both groups.
Results: Twenty-three patients with iatrogenic UTL were recruited. The overall incidence was 0.5%. UN level in peritoneal fluid (322 ± 56 mg/dL) was significantly higher than that in blood (18.7 ± 4.0 mg/dL, $p < 0.001$); Cr level in peritoneal fluid (69.7 ± 14.3 mg/dL) was also significantly higher than that in blood (1.5 ± 0.5 mg/dL, $p < 0.001$). UN level in peritoneal fluid was significantly higher in the iatrogenic UTL group than in the control group (322 mL/dL vs. 9.3 mL/dL, $p < 0.001$); Cr level in peritoneal fluid was also significantly higher (69.7 mg/dL vs. 0.98 mg/dL, $p < 0.001$).
Conclusion: When increased peritoneal drainage is found postoperatively in colorectal surgery, measurement of UN and Cr levels in peritoneal fluid can be a useful diagnostic tool to determine intraperitoneal iatrogenic UTL.

Keywords: creatinine; peritoneal fluid; urea nitrogen; urinary tract leakage

1. Introduction

A common problem after major colorectal surgery is increased clear peritoneal drainage during the postoperative period (>500 mL/d).[1] The major differential diagnosis is between simple peritoneal drainage and iatrogenic urinary tract leakage (UTL), especially the ureteral injury. The incidence of operative ureteral injury with open or laparoscopic surgery ranges from <1% to 8%.[2–4] Bladder injuries are rare (<1%) during colorectal surgery.[2] Some iatrogenic UTLs are detected intraoperatively, and repair of the injury can be undertaken immediately. However, most of the injuries may remain undetected intraoperatively and be detected during the postoperative period.[2,5]

When increased clear peritoneal drainage (>500 mL/d) is detected postoperatively, iatrogenic UTL should be first considered. Traditionally, abdominal computed tomography scan, cystography, intravenous pyelography, or uroendoscopy is performed to confirm the diagnosis.[5] The concept of urea nitrogen (UN)–creatinine (Cr) disproportion in intraperitoneal extravasation of urine was first proposed in 1972.[6] Measured levels of UN and Cr in peritoneal fluid have been compared to their levels in blood, and peritoneal fluid UN and Cr levels

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

* Corresponding author. Dr. Chao-Wen Hsu, Division of Colorectal Surgery, Kaohsiung Veterans General Hospital, 386, Dazhong 1st Road, Kaohsiung 813, Taiwan, ROC.
E-mail address: ss851124@gmail.com (C.-W. Hsu).

http://dx.doi.org/10.1016/j.jcma.2015.01.006

similar to the levels in blood are believed to be diagnostic of simple peritoneal drainage rather than UTL.[7] This diagnostic tool is not routinely utilized and is mainly applied in patients with major abdominal trauma[8] or complicated urological surgery and hysterectomy.[9] Although this diagnostic tool could also be used to detect iatrogenic UTL after major colorectal surgery, little literature was found through a search of MEDLINE and PubMed. Therefore, in this study, we retrospectively analyzed patients with iatrogenic UTL and evaluated this diagnostic tool for its possible application in colorectal surgery.

2. Methods

At Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, we reviewed the medical records and operation notes for all patients receiving colorectal surgery during 2000–2013. We used this database for our study, which was a retrospective case–control analysis with prospective collection.

In our hospital, we place at least one Jackson–Pratt drain intraperitoneally in all patients receiving colorectal surgery. When massive peritoneal fluid (500 mL/d) from Jackson–Pratt drain is detected postoperatively, we send it for measurement of UN and Cr levels to exclude UTL. Meanwhile, we collect blood and urine samples and measure their UN and Cr levels for comparison. If iatrogenic UTL is highly suspected by the analysis result, we perform sonography, abdominal computed tomography scan, cystography, intravenous pyelography, or uroendoscopy to confirm the diagnosis.

In this study, we included patients with iatrogenic UTL detected postoperatively. During the same period, we also assigned all patients with simple increased peritoneal fluid (500 mL/d) but without iatrogenic UTL (confirmed by sonography, abdominal computed tomography scan, cystography, intravenous pyelography, or uroendoscopy) to the control group. Patients with congestive heart disease, chronic liver disease with impaired liver function, and chronic renal disease with impaired renal function were excluded due to possible interference of UN and Cr levels.[10] The clinical parameters included age, sex, procedure name, site and mechanism of UTL, peritoneal fluid amount, and UN and Cr levels of peritoneal fluid, blood, and urine. We also calculated the ratios of UN and Cr levels in peritoneal fluid and blood in each group of patients for comparison. Prevention and management of UTL were not evaluated in this study.

All quantitative data were expressed as mean ± standard deviation. Analysis of variance with *post hoc* test and two independent sample *t* test were used for group comparisons of quantitative data. Statistical analysis was performed using SPSS version 12.0 for Windows (SPSS Inc., Chicago, IL, USA). Significance was defined as $p < 0.05$.

3. Results

In 2000–2013, 4493 patients receiving major colorectal surgery were registered in our medical record database. Twenty-three patients had definite diagnosis of iatrogenic UTL, and the overall incidence rate was 0.5%. Due to the retrospective nature of the study, parts of the data were missing. The clinical characteristics are shown in Table 1. Seventeen patients (74%) had open surgery, and six patients (26%) had laparoscopic surgery. The most common procedures were low anterior resection ($n = 7$) and anterior resection ($n = 6$). Most of the injuries occurred over the left ureter (82.6%), especially over the left middle third (M/3) and lower third. Two patients had bladder injury. One patient had ureteral injury over the right middle third and one patient had urethral injury. The common mechanisms were laceration ($n = 8$), ligation ($n = 6$), and thermal injury (including those caused during electrocautery and by vessel-sealing device, $n = 5$). Two patients had ureteroureterostomy leakage, and two patients had leakage from bladder repair.

UN and Cr levels in the peritoneal fluid, blood, and urine of 23 patients with iatrogenic UTL are shown in Table 2. UN/Cr levels in peritoneal fluid (322.1/69.7 mg/dL) were significantly higher than those in blood (18.7/1.5 mg/dL, $p < 0.001$) and significantly lower than those in urine (392.6/127.3 mg/dL, $p < 0.001$). Comparisons between patients with iatrogenic UTL and those of the control group are shown in Table 3. Peritoneal fluid amount and the levels of peritoneal UN, peritoneal Cr, blood UN, and blood Cr were significantly higher in the iatrogenic UTL group than in the control group, especially peritoneal UN and peritoneal Cr (322 mL vs. 9.3 mL for UN, and 69.7 mg/dL vs. 0.98 mg/dL for Cr; $p < 0.001$). The ratio of UN levels in peritoneal fluid and blood was 17.9 ± 5.1 (ranged from 10 to 29), and the ratio of

Table 1
Clinical characteristics of 23 patients with urinary tract leakage.

Clinical characteristics	$n = 23$
Age (y)	60.2 ± 14 (38–78)
Female/male	10/13
Procedure	
Low anterior resection	7
Anterior resection	6
Abdominoperineal resection	3
Right hemicolectomy	1
Laparoscopic anterior resection	3
Laparoscopic low anterior resection	2
Laparoscopic abdominoperineal resection	1
Site of urinary tract injury	
Left M/3 ureter	12
Left L/3 ureter	7
Bladder dome	2
Urethra	1
Right M/3 ureter	1
Cause of urinary tract leakage	
Laceration	8
Ligation	6
Thermal injury (including electrocautery and vessel-sealing device)	5
Ureteroureterostomy leakage	2
Leakage of bladder repair	2

Quantitative data are expressed as mean ± standard deviation (range of the value).
L/3 = lower third; M/3 = middle third.