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Literature Review: Double-Barrelled Wet Colostomy (One Stoma) versus Ileal Conduit with Colostomy (Two Stomas)

Key Words

Pelvic exenteration · Ureterocolostomy · Wet colostomy

Abstract

Introduction: The aim of this literature review was to analyse the advantages and disadvantages of a traditional ileal conduit (IC) with separate colostomy technique compared to the outcomes of a double-barrelled wet colostomy (DBWC) technique. The former technique results in the formation of two stomas, and the latter results in the formation of one stoma. **Methods:** PubMed was searched electronically for articles on DBWC. Fifteen articles were retrieved and of them 13 were included in the literature review (350 patients). Of the articles, 3 directly compared DBWC to IC with colostomy. **Results:** Review of 13 DBWC articles demonstrated perioperative mortality ranging between 0 and 11.1% and postoperative complications ranging from 0 to 100%. Three of the studies directly compared DBWC to IC with colostomy; median operating times and length of stay were shorter in DBWC patients ($p < 0.001$); 30-day morbidity was reported to either be lower in the DBWC group ($p < 0.043$) or to have no statistically significant difference. Rates of mortality, pyelonephritis, electrolyte disturbances and urinary anastomotic problems did not differ between the 2 groups. **Conclusion:** The DBWC technique inherently has a benefit over the IC with colostomy technique, as it requires only one stoma.

This literature review supports the use of the technically less challenging DBWC technique as a viable alternative to the traditional IC with colostomy technique.

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Introduction

Pelvic exenteration is a radical surgical procedure that involves the removal of all pelvic structures. It was first described by Alexander Brunschwig in 1948 [1], frequently drawing criticism due to the brutal and extensive nature of the surgery. Brunschwig continued with the operations as he believed it saved lives [2]. It has now become standard practice in treating advanced or recurrent pelvic malignancies. The procedure involves removal of the bladder, and parts of the bowel, therefore, typically rendering the patient in need of both urinary and faecal diversions. Brunschwig described the first ureterocolostomy ('wet colostomy'), which involves the surgical implantation of the ureter into the colon, resulting in the formation of 'one stoma'. At that time, it was associated with significant morbidities and a high complication profile including as-

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ending pyelonephritis, foetid watery diarrhoea and electrolyte disturbances [3]. Alternative techniques were subsequently explored, and the construction of 'two stomas' became the preferred technique [3–6]. This technique involves the creation of an ileal conduit (IC) together with a separate colostomy for those who require concurrent urinary and faecal diversion. This particular technique was made popular by Bricker in 1940 [7].

In 1989, Carter et al. [8, 9] described a new technique known as the double-barrelled wet colostomy (DBWC), which did not have the same complications previously experienced with the standard wet colostomy. The technique keeps faecal and urine streams separate, thus avoiding faecal reflux and subsequently reducing the risk of ascending pyelonephritis [3]. The technique is used for pelvic exenteration and in the palliation of inoperable tumours.

The formation of stomas for urinary diversion is not without complications and various groups have considered different techniques to improve outcomes. Garde et al. [10] reported on their experience of radical cystectomies in octogenarians and observed that though there is increased risk of mortality in patients undergoing a bilateral cutaneous ureterostomy compared to a cutaneous ureteroileostomy, the increase was not significant. Berger et al. [11] reported on patients ≥ 75 years on the use of ureterocutaneostomy compared to urinary diversion with use of bowel. This study evaluated 256 patients, and revealed that ureterocutaneostomy is associated with significantly less morbidity. For the purpose of this literature review, we have defined a 'one-stoma' procedure as a DBWC and the 'two-stoma' procedure as IC with colostomy. Through this literature review we aim to analyse the advantages and disadvantages of a one-stoma versus a two-stoma technique.

Method

PubMed was searched electronically, limited to English-language journals. The following terms were searched: double-barrelled wet colostomy and DBWC. This retrieved 15 different articles, 13 of which were included in the literature review (350 patients), the other 2 were excluded as they were not relevant to this review. Of the 13 articles included, 3 directly compared DBWC to IC with colostomy.

Results

The most recent of these 3 studies directly comparing DBWC to IC with colostomy techniques is a retrospective study from Serbia between 1995 and 2012 by Pavlov et al.

[12]. This group analysed 181 cases requiring simultaneous faecal and urinary diversion. The study divided patients into 2 groups: DBWC and IC with colostomy. The median length of stay (13.1 vs. 18.1 days, $p < 0.0001$) was significantly shorter in the DBWC group. Similarly, operating times for the urinary and faecal diversion part of the operation (32 vs. 64 min, $p < 0.0001$) were also significantly shorter in the DBWC group. Overall morbidity within the first 30 days of the operation was also lower in the DBWC group (11.5 vs. 23.4%, $p = 0.0432$). The difference in mortality (3.8 vs. 10.3%, $p = 0.1282$) and general complications including pyelonephritis, electrolyte imbalance and uretero-enteric anastomosis problems were statistically insignificant [12].

A similar single-institution study published in 2013 by Backes et al. [13] analysed complications in 33 cases retrospectively between 2000 and 2011. Similarly to the study by Pavlov et al. [12], the median length of stay (14.5 vs. 26 days, $p = 0.01$) as well as the mean operating times (610 vs. 720 min, $p = 0.04$) were both lower in the DBWC group compared to the IC with colostomy group. Perioperative morbidity was encountered by 4 of 12 patients in the DBWC group, one had sepsis, another had pyelonephritis, and 2 required percutaneous nephrostomies. Comparatively, in the IC with colostomy group, 11 patients encountered 31 cases of morbidity. Statistical differences in the following morbidities were observed between the 2 groups; bowel anastomoses ($p < 0.01$), pouch leak ($p = 0.014$), patients with leak ($p = 0.005$), sepsis ($p = 0.03$), percutaneous nephrostomy ($p = 0.04$), all of which were lower in the DBWC group. The other morbidities observed were anastomotic leaks, pyelonephritis, electrolyte abnormalities, which did not display any statistical differences; however, an overall trend of fewer morbidities was observed in the DBWC group. It is worth noting that no bowel anastomotic leaks were observed in the DBWC group, which is not surprising as bowel anastomoses are not required when the DBWC technique is used [13].

Both these studies show consistency in terms of median operating times, median length of stay, associated morbidity and complication rates. In contrast, one retrospective study on 53 patients by Chokshi et al. [14] between 2004 and 2010 reported conflicting results to the 2 previously discussed studies. In particular, mean operating times and length of stay did not differ between the 2 groups. Rather, the data showed similar times. Mean operating times for the DBWC group was 547 min compared to 549 min ($p = 0.86$) for patients in the IC group; mean length of stay for DBWC patients was 14 days compared to 16.5 days ($p = 0.86$) in the IC group. Similar dis-

Table 1. Literature review of DBWC mortality, post-operative complications and reoperations. Table modified from Golda et al. [15], 2010

Author	Year	Number	Perioperative mortality <30 days, %	Post-operative complications, %	Reoperations, %
Carter et al. [8]	1989	3	0	0	0
Carter et al. [9]	1994	11	9	45	N/A
Takada et al. [16]	1995	2	0	0	0
Osorio Gullón et al. [17]	1997	13	0	23	0
Guimaraes et al. [19]	2006	56	7.1	48.2	19.6
Lopes de Queiroz et al. [3]	2006	9	11.1	44	N/A
Kecmanovic et al. [20]	2003	38	0	15.7	0
Sukumar et al. [21]	2010	12	0	66.7	0
Golda et al. [15]	2010	41	2.4	65.9	24.4
Salgado-Cruz et al. [22]	2014	6	0	100	14.3
Chokshi et al. [14]	2011	43	0	77	N/A
Backes et al. [13]	2013	12	0	91*	58
Pavlov et al. [12]	2014	104	3.8	11.5	1

* Refers to overall complications (includes data from both the IC and the DBWC group).

Table 2. Literature review of DBWC specific complications. Table modified from Golda et al. [15], 2010

Author	Pyelonephritis, %	Anastomotic stenosis, %	Anastomotic leak, %	Urinary fistula, %	Electrolyte abnormalities, %
Carter et al. [8]	0	N/A	N/A	N/A	33.3
Carter et al. [9]	0	18.2	N/A	N/A	0
Takada et al. [16]	0	0	N/A	N/A	0
Osorio Gullón et al. [17]	7.7	7.7	7.7	7.7	0
Guimaraes et al. [19]	3.9	1.8	N/A	1.8	0
Lopes de Queiroz et al. [3]	11.1	11.1	N/A	11.1	0
Kecmanovic et al. [20]	0	2.6	N/A	2.6	0
Sukumar et al. [21]	8.3	N/A	8.3	0	0
Golda et al. [15]	9.8	2.4	2.4	N/A	0
Salgado-Cruz et al. [22]	14.3	0	0	0	14.3
Chokshi et al. [14]	2.3	N/A	18.6	14	23
Backes et al. [13]	8	N/A	0	N/A	0
Pavlov et al. [12]	1	1	1	N/A	0

crepancies in perioperative morbidity was observed, as Chokshi et al. [14] recorded no difference between IC and DBWC groups (77% DBWC vs. 60% IC, $p = 0.43$). Long-term morbidity was also reported not to differ between the 2 groups (67% DBWC vs. 60% IC, $p = 0.72$). Specific complications recorded were pyelonephritis, urinary leaks, urinary fistulas and enteric fistulas, all of which showed no statistical differences between groups.

The DBWC literature review included 13 articles, all of which are included in tables 1 and 2 [13]. Perioperative mortality (<30 days) ranged from 0 to 11.1%, with 8 of 13 studies experiencing a 0% perioperative mortality rate. Postoperative complications ranged from 0 to 100%, with

an average complication rate of 45.2%. Specific urinary complications including anastomotic stenosis ranged from 0 to 11.1%, anastomotic leaks from 0 to 18.6%, and urinary fistulas from 0 to 14%. Pyelonephritis ranged from 0 to 13.4% and electrolyte abnormalities from 0 to 33.3% [3, 8, 9, 14–22].

Discussion

To our knowledge, only 3 studies directly comparing the 2 techniques – DBWC and IC with colostomy – have been published. Two of the 3 studies report statistically

Table 3. Three studies that directly compare DWBC to IC + colostomy

	DBWC			IC + colostomy			p value		
	Pavlov et al. [12]	Backes et al. [13]	Chokshi et al. [14]	Pavlov et al. [12]	Backes et al. [13]	Chokshi et al. [14]	Pavlov et al. [12]	Backes et al. [13]	Chokshi et al. [14]
Number	104	12	43	77	11	10	–	–	–
Age, years, median (range)	54.5 (23–77)	54 (42–72)	56 (38–79)	55.4 (24–78)	57 (28–76)	62 (46–80)	0.59	0.73	0.22
Operating time, min, median (range)	32.4 (25–45)	610 (40–853)	547 (240–864)	62 (49–76)	720 (635–1,003)	549 (279–720)	<0.001	0.04	0.86
Length of stay, days, median (range)	13.1 (6–46)	14.5 (10–57)	14 (6–57)	18.1 (13–88)	26 (14–37)	16.5 (8–37)	<0.001	0.01	0.41
Morbidity (within 30 days), %	12 (11.5)	–	33 (76.7)	18 (23.4)	–	6 (60)	0.043	–	0.43
Mortality, %	4 (3.8)	0	0	8 (10.4)	0	0	0.13	1	1
Pyelonephritis, %	1 (0.96)	1 (8.3)	1 (2.3)	2 (2.6)	3 (27.3)	1 (10)	0.58	0.32	0.34
Electrolyte abnormalities, %	–	0	–	–	1 (9.1)	–	–	0.48	–
Urinary leak, %	1 (0.96)	0	8 (18.6)	2 (2.6)	2 (18.2)	3 (30)	0.58	0.48	0.42
Pouch leak, %	–	0	–	–	5 (45.5)	–	–	0.014	–
Enteric fistulas, %	1 (0.96)	–	13 (30.2)	5 (6.5)	–	1 (10)	0.085	–	0.26
Sepsis, %	–	1 (8.3)	–	–	6 (54.5)	–	–	0.03	–
Percutaneous nephrostomy, %	–	2 (16.7)	–	–	7 (63.6)	–	–	0.04	–

significant benefit with DBWC technique, while in the third study there was no statistically significant difference between the 2 techniques. The data from Pavlov et al. [12] and Backes et al. [13] on median operating times and median length of stay show statistically shorter times with a DBWC procedure. The data from Chokshi et al. [14] reported no statistically significant difference between the 2 groups; however, the median length of stay was averagely 2.5 days shorter in the DBWC group; median operating times were almost identical (table 3). The formation of a separate urinary diversion with conduit and an anastomosis of the small intestine, which are both not required in the DBWC technique can account for the longer operating times seen in the IC with colostomy group (in 2 of the 3 studies discussed above). Furthermore, avoidance of both bowel anastomosis and formation of a conduit is of benefit in these patients, as many have previously undergone radiotherapy in the abdominal region pre-surgery. Bowel irradiation results in loss of tissue planes, and increases tissue friability, thus impairing the quality of anastomosis and complexity of surgery; furthermore, many conduits are also formed from irradiated bowel, thus may predispose patients to leaks. Anastomotic leaks in particular are associated with higher morbidity and greater length of stays ($p = 0.03$) [13].

Analysis of mortality associated with DBWC and IC with colostomy procedures revealed no statistical difference in all 3 studies (table 3). Analysis of morbidity demonstrated conflicting results. Pavlov et al. [12] reported a statistically shorter 30-day morbidity in the DBWC group compared to the IC with colostomy group. Backes et al. [13] did not specify a 30-day mortality rate; however, some of the complications reported were statistically significantly less in the DBWC group, namely, pouch leakage, sepsis, and need for percutaneous nephrostomy (table 3). Comparatively, the study by Chokshi et al. [14] reported no statistical difference in 30-day mortality, or any other complication.

None of these 3 studies reported any difference between DBWC and IC with colostomy groups in terms of mortality, pyelonephritis, electrolyte imbalances, and urinary anastomotic problems. It is worth noting that none of these studies showed a statistical significant benefit favouring IC with colostomy in any evaluated parameter.

The DBWC technique inherently has a benefit over the IC with colostomy technique, as it requires only one stoma, (figure 1) which is an important factor when determining the impact on patient's quality of life. Furthermore,

Fig. 1. Diagram illustrating the DBWC procedure [20].

as discussed above, the DBWC technique has been shown to require an equal or even a shorter length of time in both the operating theatre and length of stay in hospital compared to the IC with colostomy technique. In the current economic climate, where finance is an ever-present issue, both length of time in theatre and length of stay in hospital are variables that can aid efficiency and reduce costs. Previously, the widespread use of the wet-colostomy technique was unfavourable due to complications including electrolyte disturbances and pyelonephritis; a non-reflux anastomosis used in the DBWC technique has largely remedied these problems. Relatively low rates of pyelonephritis and electrolyte abnormalities (table 3) revealed in the literature review, in addition to the lack of statistical differences seen

between DBWC and IC with colostomy groups discussed above are now observed with the DBWC technique.

In addition to the retrospective nature of the studies, another limiting factor is that there is limited quantitative evaluation of quality of life of these operations. One can argue that this will be the most important parameter determining the success of these interventions. The only quantitative evaluation to our knowledge on quality of life following a DBWC procedure was carried out by Lopes de Queiroz et al. [3]. In this study, 9 patients underwent a DBWC procedure, 5 of which responded to a quality of life questionnaire. The average global state of health was reported to be 81.7. Other DBWC articles have stated that patients who underwent the procedure experienced an improved quality of life [3, 12, 19–22].

Conclusion

Pelvic exenteration is a radical surgical procedure, frequently associated with preoperative radiotherapy thus increasing the complexity of the surgery. This review supports the use of the technically less challenging DBWC technique as a viable alternative to the traditional IC with colostomy technique. However, there is limited quantitative evaluation on the quality of life as a result of these interventions.

It is recommended that further studies are undertaken to evaluate these surgical options in a prospective manner with estimation of quality of life in addition to standard clinical parameters. Issues pertaining to stoma care and skin irritation need special evaluation. This literature review was unable to find any studies comparing colonic conduit with colostomy to DBWC. Further studies should investigate the differences between these 2 techniques.

References

- 1 Brunschwig A: Complete excision of pelvic viscera for advanced carcinoma; a one-stage abdominoperineal operation with end colostomy and bilateral ureteral implantation into the colon above the colostomy. *Cancer* 1948; 1:177–183.
- 2 [Alexander Brunschwig (1901–1969)]. *CA Cancer J Clin* 1974;24:361–362.
- 3 Lopes de Queiroz F, Barbosa-Silva T, Pyramo Costa LM, Werneck Côrtes BJ, Figueiredo JA, Guerra F, et al: Double-barrelled wet colostomy with simultaneous urinary and faecal diversion: results in 9 patients and review of the literature. *Colorectal Dis* 2006;8: 353–359.
- 4 Avradopoulos KA, Veziridis MP, Wanebo HJ: Pelvic exenteration for recurrent rectal cancer. *Adv Surg* 1996;29:215–233.
- 5 Petros JG, Augustinos P, Lopez MJ: Pelvic exenteration for carcinoma of the colon and rectum. *Semin Surg Oncol* 1999;17:206–212.
- 6 Lopez MJ, Spratt JS: Exenterative pelvic surgery. *J Surg Oncol* 1999;72:102–114.
- 7 Bricker EM: Bladder substitution after pelvic evisceration. *Surg Clin North Am* 1950;30: 1511–1521.
- 8 Carter MF, Dalton DP, Garnett JE: Simultaneous diversion of the urinary and fecal streams utilizing a single abdominal stoma: the double-barreled wet colostomy. *J Urol* 1989;141:1189–1191.
- 9 Carter MF, Dalton DP, Garnett JE: The double-barreled wet colostomy: long-term experience with the first 11 patients. *J Urol* 1994; 152(6 pt 2):2312–2315.
- 10 Garde H, Ciappara M, Galante I, Fuentes Ferrer M, Gómez A, et al: Radical cystectomy in octogenarian patients: a difficult decision to take. *Urol Int* 2015;94:390–393.

- 11 Berger I, Wehrberger C, Ponholzer A, Wolfgang M, Martini T, et al: Impact of the use of bowel for urinary diversion on perioperative complications and 90-day mortality in patients aged 75 years or older. *Urol Int* 2015; 94:394–400.
- 12 Pavlov MJ, Ceranic MS, Nale DP, Latincic SM, Kecmanovic DM: Double-barreled wet colostomy versus ileal conduit and terminal colostomy for urinary and fecal diversion: a single institution experience. *Scand J Surg* 2014;103:189–194.
- 13 Backes FJ, Tierney BJ, Eisenhauer EL, Bahnsen RR, Cohn DE, Fowler JM: Complications after double-barreled wet colostomy compared to separate urinary and fecal diversion during pelvic exenteration: time to change back? *Gynecol Oncol* 2013;128:60–64.
- 14 Chokshi RJ, Kuhrt MP, Schmidt C, Arrese D, Routt M, Parks L, et al: Single institution experience comparing double-barreled wet colostomy to ileal conduit for urinary and fecal diversion. *Urology* 2011;78:856–862.
- 15 Golda T, Biondo S, Kreisler E, Frago R, Fracalvieri D, Millan M: Follow-up of double-barreled wet colostomy after pelvic exenteration at a single institution. *Dis Colon Rectum* 2010;53:822–829.
- 16 Takada H, Yoshioka K, Boku T, Yoshida R, Nakagawa K, Matsuda T, Hioki K: Double-barreled wet colostomy. A simple method of urinary diversion for patients undergoing pelvic exenteration. *Dis Colon Rectum* 1995; 38:1325–1326.
- 17 Osorio Gullón A, de Oca J, López Costea MA, Virgili J, Ramos E, del Rio C, Martí Ragué J: Double-barreled wet colostomy: a safe and simple method after pelvic exenteration. *Int J Colorectal Dis* 1997;12:37–41.
- 18 Blanco Díez A, Fernández Rosado E, Alvarez Castelo L, Sánchez Rodríguez-Losada J, Chantada Abal V, Novás Castro S, et al: [Double-barreled wet colostomy: analysis of a urinary diversion]. *Actas Urol Esp* 2003;27: 611–617.
- 19 Guimaraes GC, Ferreira FO, Rossi BM, Aguiar S Jr, Zequi SC, Bachega W, et al: Double-barreled wet colostomy is a safe option for simultaneous urinary and fecal diversion. Analysis of 56 procedures from a single institution. *J Surg Oncol* 2006;93:206–211.
- 20 Kecmanovic DM, Pavlov MJ, Kovacevic PA, Sepetkovski AV, Ceranic MS, Stamenkovic AB: Management of advanced pelvic cancer by exenteration. *Eur J Surg Oncol* 2003;29: 743–746.
- 21 Sukumar S, Sivanandam E, Bhat HS, Mathew G, Sudheer OV, Dhar P: Revisiting the double-barreled wet colostomy for simultaneous urinary and fecal diversion – an Indian experience. *Indian J Gastroenterol* 2010;29: 240–243.
- 22 Salgado-Cruz L, Espin-Basany E, Vallribera-Valls F, Sanchez-Garcia J, Jimenez-Gomez LM, Marti-Gallostra M, Garza-Maldonado A: Double barreled wet colostomy: initial experience and literature review. *Scientific-WorldJournal* 2014;2014:961409.