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Title: Management of primary and metastatic malignant small bowel obstruction, operate or palliate. A systematic review.

Short running title: Malignant small bowel obstruction

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Abstract**Background:**

The management of patients presenting with malignant small bowel obstruction is a challenging paradigm. The aim of this systematic review was to examine different management strategies in these complex patients. The primary outcomes evaluated were the type of intervention, 30-day morbidity and mortality and overall survival rates.

Methods:

A systematic literature review of EMBASE, MEDLINE, PUBMED and the Cochrane library was performed using PRISMA for studies reporting on conservative and operative management of malignant small bowel obstruction.

Results:

Fifteen studies (n=882 patients) reporting on outcomes for malignant small bowel obstruction were analysed. Outcomes measured were primarily survival and relief of obstructive symptoms. The median age ranged from 52-66 years. The most common cause of malignant small bowel obstruction was gynaecological in nature (56%), followed by colorectal (19%). 486 patients underwent primary surgical management and the remaining 396 patients were assigned to non-surgical intervention. Median overall survival in the operative studies ranged from 2.5 to 7.4 months, compared with 0.9 to 1.9 months ($p<0.05$). 30-day mortality ranged from 13-28% in those who underwent surgical interventions versus 2-61% in the non-surgical group ($p=0.09$). No significant difference in median survival in GI and gynaecological malignancies was observed (4.3 months vs 5.0 months, $p=0.12$). Morbidity ranged from 21-85% in the surgical group and 12-29% in the percutaneous groups ($p<0.05$).

Conclusions:

Surgical intervention in malignant small bowel obstruction is associated with significant morbidity, although it may improve survival in selected patients with gynaecological and colorectal malignancy. It is imperative that realistic goals and expectations are discussed with patients preoperatively.

Introduction

Small bowel obstruction is a well-recognised complication of advanced malignancy, particularly of gastrointestinal and gynaecological origin. The incidence of this varies widely in reports, however ranges include 10-28% for gastrointestinal malignancies with higher rates reported for gynaecological cancers [1-4]. Malignant bowel obstructions cause severe pain, anorexia and nausea and vomiting[5]. This is a particular challenge for oncological and palliative care services and is often characteristic of a sentinel pre-terminal event. The pathogenesis of the vast majority of these are malignant in nature via transcelomic spread of the primary disease [5], although given the previous treatment modalities of such patients, adhesional small bowel obstructions must always be considered. As would be expected, survival benefits are significantly higher for patients with adhesional obstructions and as such, this is an important diagnostic distinction to ascertain [6]. To date, there are no definite guidelines highlighting which patients should undergo operative rather than conservative management. Moreover, much of the data to date surrounding this topic has arisen from single centres with small cohorts.

It is evident that there are two distinct groups of patients within whom this condition may arise. Firstly, those who present with a malignant obstruction in the terminal phase of their condition.

These patients are rarely appropriate for surgical intervention and rely on non-operative management strategies to retain as much quality of life as is possible. Secondly, there is a small cohort of patients who present with this condition as a first presentation of peritoneal disease and have the required physiological reserve to undergo the stressors associated with operative intervention. Such patients with a low Peritoneal Carcinomatosis Index (PCI) will benefit from surgical intervention to firstly resolve their obstruction as well as systemic and/or cytoreductive procedure in the elective phase. This may or may not include Hyperthermic Intraperitoneal Chemotherapy (HIPEC) given PCI score.

There is currently a paucity of evidence surrounding the surgical intervention for malignant small bowel obstruction due to the heterogeneity of studies with significant selection bias in those deemed appropriate for surgical intervention. The difficult decision that remains in the medical community at this time is determining appropriate management strategy for such patients and thus aiding goals of care and the consenting process [7]. Scoring systems have been trialled to best predict outcomes based on premorbid function, however have not been adopted into widespread practice [8]. Furthermore, despite advances in Computed Tomography (CT) and Positron Emission Tomography (PET), imaging alone is not able to easily delineate between adhesional and malignant obstructions nor are they able to accurately quantify a patients PCI score. The challenge to clinicians and researchers in the palliative setting is to provide the best outcome for each individual patient, whilst continuing to seek improvements in outcomes for future cohorts. Unfortunately, there is a lack of randomised trials in this space and the logistics of this is exceedingly difficult for most clinical settings.

The aim of this study is to review the literature surrounding the management strategies of patients presenting with small bowel obstruction in the setting of known malignant disease in an attempt to delineate outcomes in operative and medical managed patients. Moreover, outcomes from

the underlying pathological disease process is analysed with short and long-term morbidity and mortality reported.

Methods

Search Strategy

A systematic review of published work was conducted as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for the conduct of a review study. The study team developed a concept table and built a search strategy with a medical librarian to identify articles reporting outcomes in operative versus conservative management in malignant small bowel obstruction. Three concepts were developed: operative, decompressive and conservative management

of patients with malignant small bowel obstruction. Each individual database was searched using the Medical Subject Headings (MeSH) term “intestinal obstruction” as well as the free text “small bowel obstruction” combined with the “or” function. This search was further supplemented with the free text term “malignant” and was combined with the “and” function. Exploded medical subject heading (MeSH) terms were combined with text word searching using the Boolean operator ‘OR’ for each concept. Each concept was combined with ‘AND’. Variation in spelling were accounted for using ‘*’ in the search to represent wildcard characters. No search limits were applied and all languages were included. Four databases were searched; Medline (Ovid:1946-present), PubMed (NCBI), EMBase (Ovid:1966-present) and Cochrane Library. The final search date was 31st August, 2018. Reference lists of included articles were also searched and further articles included if appropriate. The full search strategy used is summarised in Figure 1.

Inclusion & Exclusion Criteria

To minimise selection, reporting and publication bias, any case reports or small series from single centres (≤ 5 patients) were excluded. In addition, the protocol inclusion criterion was designed to include original research describing the outcomes of management of malignant small bowel obstruction. Outcomes were primarily survival and relief of obstructive symptoms.

Articles were excluded that discussed malignant obstruction of the oesophagus, stomach, gastric outlet, duodenum, biliary, pancreatic or ampullary, ureteric, colonic and the rectum. Papers that included radiation induced strictures were excluded. Articles that discussed benign tumours, conditions or strictures of the small bowel were also excluded. We also excluded intraluminal tumours of the small bowel as these require a different management algorithm. Furthermore, research that did not delineate the outcomes between small and large bowel obstruction were excluded.

Editorials, comments, protocols, conference abstracts and review articles were reviewed for

bibliographic references, however were not included in the final systematic review. Articles that used animals were excluded from the search.

Study Selection

Using pre-defined data fields, two authors (SPB & OP) independently assessed the study titles and abstracts for inclusion. We obtained the full list of abstracts for these titles and two reviewers separate from the primary author (OP and PSW) analysed the abstracts collated. They discussed and resolved any differences in title selection between them, with a third assessor independently reconciling any differences in abstract selection. Full-text versions of potentially eligible studies were retrieved, which were further assessed by two independent study authors against the inclusion/exclusion criteria and a consensus was reached.

Data Extraction & Outcomes

One author extracted information from the studies using a standardised spreadsheet. Data extracted included study year, study design and purpose, patient demographics, cancer stage, conversion to open procedure, morbidity and mortality, type of surgical resection and length of follow-up.

Risk of Bias Assessment

Two study authors assessed risk of bias independently and a third author resolved any discrepancies, using the Newcastle Ottawa Scale for cohort studies (Table 1). Data recorded included incomplete outcome data, clearly defined outcome measures and other sources of bias. Studies were assigned a score based on selection, comparability and outcome using the published criteria.

Data Synthesis

The heterogeneous nature of the methodology and data collected from this systematic review did not allow meta-analysis to be conducted.

Results

Patient Cohort

2848 articles were identified from the databases search and an additional 14 articles were sourced from the review of various bibliographies. The total search yielded 2862 articles. 531 articles were found to be duplicates and as such revealed 2331 unique titles. After an initial review of the titles, 2150 papers were excluded. The remaining 181 abstracts were reviewed and a total of 57 full text articles were retrieved. A final 16 studies [9-24] were found to meet the predetermined protocol. Two studies reported outcomes on the same patient group and as such were included as one cohort. Finally, 15 studies were included in the review (Table 2).

Patient management

The 15 studies were published between 1976 and 2017. Nine studies investigated the outcomes of patients who underwent operative intervention for malignant small bowel obstruction. Operative procedures performed included exploratory laparotomy (with no further procedure), division of malignant adhesions, small bowel resection, small bowel bypass or formation of an ostomy (both end or loop ileostomy). These operative interventions were generally performed after a period of observation with nasogastric decompressive methods and medical management of patient's symptoms. The remaining six studies reported on outcomes in the non-surgical intervention group – four studies investigated the use of decompressive percutaneous endoscopic gastrostomy tube placement; one study utilised needle decompression of the small bowel for symptom control and one study used percutaneous jejunostomy tube and small bowel stenting for decompression.

Survival

There was a variety of underlying primary malignancies across the cohorts of patients with peritoneal carcinomatosis. These most commonly included gynaecologic (ovarian, endometrial and cervical) (56%), colorectal (19%) followed by gastric, peritoneal, pancreatic, biliary and melanoma respectively. Five studies presented data on patients with gynaecological associated small bowel malignancies. Two studies did not delineate the origin of the primary malignancy. A total of 882 patients with a median age ranging from 52-66 were reported on across the 15 studies. 486 patients underwent surgical intervention and the remaining 396 patients had non-surgical intervention. The median survival in the operative studies ranged from 2.5 to 7.4 months compared with 0.9 to 1.9 months in the non-operative group ($p<0.05$). 30-mortality ranged from 13-28% in those who underwent surgical interventions and in the non-surgical group this ranged from 2-61% ($p=0.09$).

Gastrointestinal v Gynaecological malignancy

A sub-group analysis of the available data was carried out to compare the outcomes of those with gastrointestinal malignancy ($n=120$) compared to those with malignancy of gynaecological origin ($n=159$, Table 3). This found no statistically significant difference with the median survival of each cohort (4.3 months v 5.0 months, $p=0.12$). A number of the papers ($n=8$) included in the systematic review did not have the published data to allow for this sub group analysis.

Complications

Complications ranged from 21-44% in the surgical group ($n=249$) and 12-29% in the non-operative group ($n=375$) where available data was published ($p<0.05$, Table 4). There was heterogeneous reporting of complications with studies reporting on complications related to the primary pathology and those related to the surgical intervention performed. Where available, results found that medical

complications were most commonly encountered. Surgical complications included infections, anastomotic leaks and enterocutaneous fistulae.

Discussion

The multimodal management of malignant small bowel obstruction commonly presents as a difficult challenge to the multidisciplinary team and is often characterised as a pre-terminal event. With a reported prevalence of 15% in cancer patients, the quality of life with palliative measures remains suboptimal despite significant improvements over the past decades. Herein, the results highlight that surgical intervention is associated with an increased survival rate for patients. Where reported however, there is no significant difference in 30-day mortality in operative versus non-operative managed cohorts. This suggests an obvious patient selection bias and that the survival benefit of an operation is only recognised for those that can withstand the associated physiological insults of abdominal surgery. These findings are in keeping with outcomes described in previous studies and as such, careful patient selection is imperative [25]. To date it has been documented in the literature that increased age, advanced disease, deterioration in general status and malnutrition are primary factors associated with poor prognosis in cases where surgery may be feasible [26]. Patients undergoing

surgery with suboptimal nutritional status and a pre-operative diagnosis of hypalbuminaemia have an associated three-fold increased risk of mortality [15, 27]. However, when analysing the underlying primary disease process and overall outcome in this review it is established that there was no significant difference in patients with GI or gynaecological malignancies. Interestingly, this is a result that has not been commonly reported in the literature and allows clinicians to stratify and primarily manage patient symptoms irrespective of concerns of the underlying primary pathological diagnosis.

The sub group analysis of those managed with surgery compared to non-operative techniques in the current study yielded high rates of morbidity in both cohorts. This result is not unexpected given the comorbid backgrounds of such a patient population. The aim of surgical intervention in these patients is to re-establish GI continuity to allow digestive absorption whilst eliminating the obstruction by either resection, surgical bypass or stoma formation thus relieving the symptoms of obstruction. It is noted that the operative group had a statistically higher rate of complications given the invasive nature of open abdominal surgery, however it is interesting to note that these differences are not more pronounced. Studies examining operative intervention in patients with gynaecological malignancy have eluded to increased complications and mortality in those with prior history of pelvic and abdominal radiotherapy [1]. In addition, those with previous chemotherapy and no history of ascites had significantly increased survival [28, 29].

The complication rates demonstrated in the non-operative group of 12% – 29% is in keeping with those previously described [30, 31]. It is estimated that parenteral nutrition and nasogastric tube insertion with aspiration can achieve symptom control in approximately 80% of patients [32]. Moreover, the authors report that approximately 30% of patients will spontaneously decompress and resolve with a mean time of less than eight days after nasogastric tube insertion provided there is no ongoing sepsis or peritonitis. It is hypothesised that early nasogastric tube insertion on patient presentation can increase the probability of spontaneous resolution as it greatly decreases endoluminal

pressure and subsequent bowel wall oedema. Increasingly, water-soluble oral contrast has been utilised by medical oncologists prior to surgical referral in such patients in which previous operative intervention has been undertaken and thus adhesive obstruction may represent the underlying causative factor. It is useful to predict which patients are likely to require operative intervention and those that will resolve spontaneously. Within the current review the majority of non-operative approaches included PEG tube insertion, needle decompression and rarely stent insertion. The search strategy yielded numerous papers that investigated the management of bowel obstruction using medical techniques such as octreotide. These studies have shown octreotide reduces the gastrointestinal secretions significantly and improves patient symptoms[33-35]. These studies, however, were removed from our selection as they did not differentiate their cohort outcomes between those that had a small and large bowel obstructions. Endoluminal stent insertion as an adjunct in the treatment of small bowel obstruction has displayed promising results when compared to surgical intervention such as gastrojejunostomy in very proximal obstructions such as the duodenum [36]. With similar early and late complication rates and profiles, patients undergoing surgical bypass have prolonged survival (105 v 165 days), which may be due to inherent patient selection bias for surgery. Despite the short-term patient benefits of endoscopic stent placement, complications such as stent perforation (4.5%) and/or migration (11%) with the potential for tumour ingrowth and subsequent re-obstruction requires careful consideration [37, 38]. PEG tube insertion has been utilised in this review in patients predominantly presenting with gynaecological related malignancies. A PEG tube negates the use of a nasogastric tube and its secondary side effects such as stricture formation, discomfort, nasal erosions and bronchoaspiration. PEG tube insertion was associated with significantly reduced mean survival in this study of 0.9 -1.9 months when compared to operative approaches. Due to ease of insertion in 94 – 98% of reported cases with greater than 80% symptom control, it is generally reserved for those patients in which a minimal physiological insult would be

beneficial and unlikely to survive a resection or bypass [17, 39]. Although not evaluated in the current study, the roll of total parental nutrition (TPN) in this cohort of patients is contentious with a scarcity of studies outlining the efficacy of such a treatment strategy over a prolonged duration. Its routine use is not recommended unless patients are potentially curable or have the possibility of responding to and surviving multimodal treatments such as chemotherapy and/or radiotherapy for greater than three months [40]. Limited data available report that nutritional stability is maintained for approximately two to three months prior to death and only 30% of patients living beyond three months actually benefit from TPN use [41].

There are a number of recognised limitations with this study. Firstly, the patient cohort ranges from 1976 to 2017. The last study that reported overall survival in a surgical group was in 2006 by Abbas et al. Moreover, there has been a deficiency in reporting of surgical outcomes in this cohort over the last decade thus making decision making more difficult. This 41-year timeframe has seen significant advancement in management of oncology, from both a surgical and medical perspective. In particular, surgical techniques and materials used have changed over this period and makes comparison of the cohorts difficult. In addition, survival in metastatic gynaecological cancer has dramatically improved likely to a combination of better surgery and aftercare as well as an improvement in the types and delivery of chemotherapy. Finally, palliative care services have vastly changed across this time period, enabling improved quality of life outcomes for patients with malignant small bowel obstruction[2, 4]. Patients from this study presenting with small bowel obstructions were not limited to one particular type of cancer. The natural history of these malignancies can be vastly different within their own disease type (ie: low grade vs. high grade tumours) and as such management techniques should be appropriately geared to each individual disease [42]. The above-mentioned population of patients is heterogenous across numerous hospital centres, countries, disease processes and across decades of time. There are numerous other variables

that have an important role in the survival of patients with terminal malignancies. The role of multidisciplinary teams, medical and radiation oncology, palliative care services, the role of allied health staff and the role of nutrition to mention a few[32]. In such patients MDT discussion prior to intervention if time allows, can be invaluable in order to ascertain the projected pathway of the patient's disease process as estimated by the oncologists. This is now increasingly more important due to the introduction of more effective chemotherapy such as carboplatin-taxane combination therapy for serous ovarian cancer which renders some of the studies prior to 1995 less relevant to common practice. In addition, it is important to note that patients managed with PEG tube insertion are likely to represent a cohort of patients with proximal obstruction and greater physiological disturbances requiring a more complex operative intervention. Significant bias towards non-operative management exists in such a cohort and are therefore difficult to compare to the operative intervention group.

Despite these limitations, this is an area of surgical oncology that requires ongoing investigation as patients continue to have improved survival from their primary pathology and are now continuing to present with metastatic disease. Medical professionals are not dealing with one entity or parameter and instead are attempting to make recommendations and treatment strategies based on numerous factors such as patient co-morbidities, underlying primary disease status, expectations and resource availability. The role of this systematic review was to review the literature for the management options available for small bowel obstruction and therefore improve the patient and family counselling/consenting process. It has demonstrated that surgery does improve survival for patients with a malignant small bowel obstruction, however there is a significant complication risk profile and it is imperative that realistic goals are set and limitations are discussed with patients and family preoperatively.

Figure legends:

Figure 1: PRISMA flow diagram of reviewed articles and final article selection for inclusion.

Table 1: Newcastle Ottawa Scale Risk of Bias Assessment for Cohort Studies.

Table 2: Identified original articles meeting the inclusion criteria for operative and non-operative management.

Table 3: Gastrointestinal Vs. Gynaecological Primary – Survival outcomes based on primary pathology.

Table 4: Non-Operative vs. Operative Complication Rates.

Bibliography

1. Feuer, DJ. , et al., *Systematic review of surgery in malignant bowel obstruction in advanced gynecological and gastrointestinal cancer. The Systematic Review Steering Committee.* Gynecologic Oncology, 1999. **75**(3): p. 10.
2. Mercadante, S., A. Casuccio, and S. Mangione, *Medical Treatment for Inoperable Malignant Bowel Obstruction: A Qualitative Systematic Review.* Journal of Pain and Symptom Management, 2007. **33**(2): p. 7.
3. Wright, FC., et al., *Predictors of survival in patients with non-curative stage IV cancer and malignant bowel obstruction.* Journal of Surgical Oncology, 2010. **101**(5): p. 5.
4. Obita, GP., et al., *Somatostatin Analogues Compared With Placebo and Other Pharmacologic Agents in the Management of Symptoms of Inoperable Malignant Bowel Obstruction: A Systematic Review.* Journal of Pain and Symptom Management 2016. **52**(6): p. 19.
5. Shariat-Madar, B., et al., *Surgical management of bowel obstruction in patients with peritoneal carcinomatosis. [Review].* Journal of Surgical Oncology, 2014. **110**(6): p. 4.
6. Lau, PW. and Lorentz TG., *Results of surgery for malignant bowel obstruction in advanced, unresectable, recurrent colorectal cancer.* Diseases of the Colon & Rectum, 1993. **36**(1): p. 4.
7. Paul Olson, TJ., et al., *Palliative surgery for malignant bowel obstruction from carcinomatosis: a systematic review. [Review].* JAMA Surgery, 2014. **149**(4): p. 10.
8. Henry, JC., et al., *A scoring system for the prognosis and treatment of malignant bowel obstruction.* Surgery, 2012. **152**(4): p. 10.
9. Laws, KL. and JS. Aldrete, *Small-bowel obstruction: a review of 465 cases.* Southern Medical Journal, 1976. **69**(6): p. 2.
10. Piver, MS., et al., *Survival After Ovarian Cancer Induced Intestinal Obstruction.* Gynaecologic Oncology, 1982. **13**(1): p. 6.
11. Solomon, HJ., et al., *Bowel complications in the management of ovarian cancer.* The Australian & New Zealand Journal of Obstetrics and Gynaecology, 1983. **23**(2): p. 4.
12. Rubin, SC., et al., *Palliative Surgery for Intestinal Obstruction in Advanced Ovarian Cancer.* Gynaecologic Oncology, 1989. **34**(1): p. 4.
13. Turnbull, ADM., J. Guerra, and H. Fletcher Starnes, *Results of Surgery for Obstructing Carcinomatosis of Gastrointestinal, Pancreatic or Biliary Origin.* Journal of Clinical Oncology, 1989. **7**(3): p. 6.
14. Lee, MJ., et al., *Malignant small bowel obstruction and ascites: not a contraindication to percutaneous gastrostomy.* Clinical Radiology, 1991. **44**(5): p. 3.
15. Blair, SL., DZ. Chu, and RE. Schwarz, *Outcome of Palliative Operations for Malignant Bowel Obstruction in Patients With Peritoneal Carcinomatosis From Nongynecological Cancer.* Annals of Surgica Oncology, 2001. **8**(8): p. 6.
16. Pothuri, B., et al., *Palliative Surgery for Bowel Obstruction in Recurrent Ovarian Cancer/ An Updated Series.* Gynaecologic Oncology, 2003. **89**(2): p. 8.
17. Pothuri, B., et al., *Percutaneous endoscopic gastrostomy tube placement in patients with malignant bowel obstruction due to ovarian carcinoma.* Gynecologic Oncology, 2005. **96**: p. 5.
18. Abbas, SM. and AE. Merrier, *Palliative Small Bowel Surgery in Patients with History of Malignancy.* International Journal of Cancer Research, 2006. **2**(1): p. 5.

19. Kim, YJ., et al., *Safety and efficacy of radiological percutaneous jejunostomy for decompression of malignant small bowel obstruction*. European Radiology, 2013. **23**(10): p. 7.
20. Jiang, TH., et al., *Percutaneous needle decompression in treatment of malignant small bowel obstruction*. World Journal of Gastroenterology, 2015. **21**(8): p. 8.
21. Zucchi, E., et al., *Decompressive percutaneous endoscopic gastrostomy in advanced cancer patients with small-bowel obstruction is feasible and effective: a large prospective study*. Supportive Care in Cancer, 2016. **24**(7): p. 6.
22. Wancata, LM, et al., *Outcomes After Surgery for Benign and Malignant Small Bowel Obstruction*. Journal of Gastrointestinal Surgery, 2017. **21**(2): p. 9.
23. Dittrich, A., et al., *Benefits and risks of a percutaneous endoscopic gastrostomy (PEG) for decompression in patients with malignant gastrointestinal obstruction*. Supportive Care in Cancer, 2017. **25**(9): p. 8.
24. Abbas, SM. and AE. Merrier, *Resection of peritoneal metastases causing malignant small bowel obstruction*. World Journal of Surgical Oncology, 2007. **5**: p. 4.
25. Daniele, A., et al., *Palliative care in patients with ovarian cancer and bowel obstruction*. Supportive Care in Cancer, 2015. **23**(11): p. 7.
26. Helyer L, Easson AM *Surgical approaches to malignant bowel obstruction*. J Support Oncol. 2008 Mar; 6(3):105-13.
27. Bryan DN, Radbod R, Berek JS. *An analysis of surgical versus chemotherapeutic intervention for the management of intestinal obstruction in advanced ovarian cancer*. Int J Gynecol Cancer. 2006 Jan-Feb; 16(1):125-34.
28. Parker MC, Baines MJ. *Intestinal obstruction in patients with advanced malignant disease*. Br J Surg. 1996;83(1):1–2.
29. Zoetmulder FA, Helmerhorst TJ, van Coevorden F, Wolfs PE, Leyer JP, Hart AA. *Management of bowel obstruction in patients with advanced ovarian cancer*. Eur J Cancer. 1994;30A(11):1625–1628.
30. Rath, KS. , et al., *Outcomes following percutaneous upper gastrointestinal decompressive tube placement for malignant bowel obstruction in ovarian cancer*. Gynecologic Oncology, 2013. **129**(1): p. 4.
31. Kawata, N., et al., *Percutaneous endoscopic gastrostomy for decompression of malignant bowel obstruction*. Digestive Endoscopy, 2014. **26**(2): p. 6.
32. Tuca A, Guell E, Martinez-Losada E, Codorniu N. *Malignant bowel obstruction in advanced cancer patients: epidemiology, management, and factors influencing spontaneous resolution*. Cancer Manag Res. 2012;4:159–169. doi:10.2147/CMAR.S29297
33. Currow, DC., et al., *Double-blind, placebo-controlled, randomized trial of octreotide in malignant bowel obstruction*. Journal of Pain and Symptom Management, 2015. **49**(5): p. 8.
34. Peng, X., et al., *Randomized clinical trial comparing octreotide and scopolamine butylbromide in symptom control of patients with inoperable bowel obstruction due to advanced ovarian cancer*. World Journal of Surgical Oncology, 2015. **13**: p. 6.
35. Watari, H., et al., *A prospective study on the efficacy of octreotide in the management of malignant bowel obstruction in gynecologic cancer*. International Journal of Gynecologic Cancer, 2012. **22**(4): p. 5.
36. Jeurnink SM, van Eijck CH, Steyerberg EW, Kuipers EJ, Siersema PD *Stent versus gastrojejunostomy for the palliation of gastric outlet obstruction: a systematic review*. BMC Gastroenterol. 2007 Jun 8; 7():18.

37. Watt AM, Faragher IG, Griffin TT, Rieger NA, Maddern GJ. *Self-expanding Metallic Stents for Relieving Malignant Colorectal Obstruction: A Systematic Review*. Ann Surg. 2007;246(1):24–30.
38. Khot UP, Lang AW, Murali K, Parker MC. *Systematic review of the efficacy and safety of colorectal stents*. Br J Surg. 2002;89(9):1096.
39. Campagnutta E, Cannizzaro R, Gallo A, et al. *Palliative treatment of upper intestinal obstruction by gynecological malignancy: the usefulness of percutaneous endoscopic gastrostomy*. Gynecol Oncol. 1996;62(1):103–105.
40. Fan BG. *Parenteral nutrition prolongs the survival of patients associated with malignant gastrointestinal obstruction*. JPEN J Parenter Enteral Nutr. 2007;31(6):508–510.
41. Bozzetti F, Cozzaglio L, Biganzoli E, et al. *Quality of life and length of survival in advanced cancer patients on home parenteral nutrition*. Clin Nutr. 2002;21(4):281–288.
42. Martinez Castro, P., et al., *Malignant Bowel Obstruction in Relapsed Ovarian Cancer With Peritoneal Carcinomatosis: An Occlusive State*. International Journal of Gynecologic Cancer, 2017. **27**(7): p. 7.
43. Fung-Kee-Fung, M., et al., *An organizational guideline for gynecologic oncology services*. Int J Gynecol Cancer, 2015. **25**(4): p. 551-8.

Figure 1: PRISMA Flow Diagram of articles reviewed

Table 1: Newcastle Ottawa Scale Risk of Bias Assessment for Cohort Studies

Study	Selection (Maximum =4)	Comparability (Maximum = 2)	Outcome (Maximum = 3)	Total (Maximum = 9)
Laws 1976	***	*	*	5
Piver 1981	**	*	**	5
Solomon 1983	**	*	**	5
Rubin 1989	***	**	***	8
Turnbull 1989	***	*	***	7
Lee 1991	**	*	**	5
Blair 2001	**	**	**	6
Pothuri 2003	***	**	***	8
Pothuri 2005	***	**	***	8
Abbas 2006	***	*	***	7
Kim 2013	***	**	***	8
Jiang 2015	****	**	**	8
Zucchi 2016	**	*	***	6
Wancata 2016	****	**	**	8
Dittrich 2017	***	**	***	8

Source (Country)	Management	No. of Patients	Female Sex, %	Median Age (range), years	Primary Cancer Site	Management Intervention	Primary Outcome	Median Time Since Initial Diagnosis (range), months	Median Survival, months	30 day mortality	Complications
Laws 1976 (USA)	Operative	47	NR	NR	NR	Surgery	Relief of obstruction 7 (54%)	NR	NR	13 (28%)	NR
Piver 1981 (USA)	Operative	60	100%	52 (31-81)	Ovarian 60	Surgery	Survival	NR	2.5 months (<1-27)	10 (17%)	19 (32%) (n=4 enterocutaneous fistulae; n=2 anastomotic leak; n=2 short gut syndrome; n= 11 medical complications); 9 deaths due to complications
Solomon 1983 (Australia)	Operative	14	100%	NR	Ovarian 14	Surgery	Relief of obstruction 13 (93%)	NR	7.4	NR	n=3 (21%) (n=1 persistent obstruction; n=1 short gut syndrome; n=1 death cardioresp. failure)
Rubin 1989 (USA)	Operative	24	100%	NR	Ovarian 24	Surgery	Relief of obstruction 18 (75%)	NR	6.7 months	NR	NR
Turnbull 1989 (USA)	Operative	89	39%	53 (19-90)	Colorectal 59; Gastric 19; HPB 8; Other 3	Surgery	Relief of obstruction 66 (74%)	15	3.2	12 (13%)	n=20 (85%)
Lee 1991 (USA)	Non-Operative	12	100%	66 (51-74)	Ovarian 10; endometrial 1; cervical 1	PEG Tube Insertion	Successful PEG insertion 12 (100%)	NR	1.9	0	n=3 (25%) (n=3 leaks)
Blair 2001 (USA)	Operative	45	NR	NR	NR	Surgery	Tolerating solid food n=16 (36%)	NR	NR	NR	NR
Pothuri 2003 (USA)	Operative	42	100%	NR	Ovarian 42	Surgery +/- PEG	Relief of obstruction 36 (86%)	NR	7.4 months	NR	NR
Abbas 2006 (NZ)/Abbas 2007 (NZ)	Operative	79	57%	62 (19-91)	Colorectal 31; Gynaecologic 19; melanoma 16; other 13	Surgery	Survival	26	5 months	NR	NR
Pothuri 2005 (USA)	Non-Operative	94	100%	56 (27-78)	Ovarian 75	PEG Tube Insertion	Symptom relief 86 (91%); tolerating at least liquids 80 (83%)	37.2	1.7	NR	N= 21 (22%) (n=8 leaks; n=3 infections; n=3 PEG obstruction; n=2 PEG migration; n=2 catheter

											malfunction; n=2 bleeding; n = 1 peritonitis)
Kim 2013 (Korea)	Non- Operative	21	23%	60 (20-81)	Gastric 7; colon 7; pancreatic 4; bladder 2; ovarian 1	Decompressive percutaneous jejunostomy and small bowel stent	Clinical successful DPJ 7 (33%); NG across obstruction 11 (92%); clinical successful stent placement 4 (80%); Overall 18 (86%)	(2-84)	NR	3 (14%)	NR
Jiang 2015 (China)	Non- Operative	52	65%	62 (27-86)	Ovarian 14; Gastric 13; Colorectal 9; Uterine/cervical 7; other 9	Needle decompression	Clinical improvement 11 (19%)	NR	NR	1 (2%)	n=6 (12%) (n= 3 leaks; n= 2 infections; n=1 puncture site metastasis)
Zucchi 2016 (Germany)	Non- Operative	142	NR	NR	Ovarian 96; Colon 13; Endometrial 8; Gastric 7; Other 18	PEG Tube Insertion	Symptom relief and tolerating oral intake 110 (77%)	NR	1.8 months (<1-15)	26 (18%)	n=41 (29%) (n=20 peristomal infections; n=12 obstruction; n=3 PEG dislodged; n=3 bleeding; n=3 other
Diuttrich 2016 (Germany)	Non- Operative	75	71%	66 (23-86)	Ovarian 24; colorectal 13; pancreatic 12; other 26	PEG Tube Insertion	Tolerated liquid or soft diet 59 (79%)	1.4 (0-14)	0.9 (<0.5- 14)	46 (61%)	n=18 (24%) major complications
Wancata 2017 (USA)	Operative	86	42%	65	NR	Surgery	Survival	NR	NR	19 (22%)	38 (44%) any complications

Table 2: Identified original articles meeting the inclusion criteria for operative and non-operative management

Table 3: Gastrointestinal Vs. Gynaecological Primary Survival

	Source	No. of Patients	Median Survival
Gastrointestinal Primary	Abbas 2006	31	7.4 months
	Turnbull 1989	89	3.2 months
TOTAL		120	4.3 months
Gynaecological Primary	Solomon 1983	14	7.4 months
	Piver 1981	60	2.5 months
	Pothuri 2003	42	7.4 months
	Rubin 1989	24	6.7 months
	Abbas 2006	19	3.7 months
TOTAL		159	5.0 months

Table 4: Non-Operative vs. Operative Complication Rates

	Source	No. of Patients	Complication Rate
Non-Operative Management	Lee 1991	12	25% (n=3)
	Pothuri (2005)	94	22% (n=21)
	Jiang (2015)	52	12% (n=6)
	Zucchi (2016)	142	29% (n=41)
	Diuttrich (2016)	75	24% (n=18)
Total		375	24% (n=89)

Operative Management	Piver 1981	60	32% (n=19)
	Solomon 1983	14	21% (n=3)
	Turnbull 1989	89	22% (n=20)
	Wancata 2017	86	44% (n=38)
Total		249	32% (n=80)

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