

10-20-2018

Anastomosis in Intestinal Tuberculosis: A Systematic Review

Agi S. Putranto

Division of Digestive Surgery, Department of Surgery, Faculty of Medicine, Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital Jakarta, agi_digestive@yahoo.com

Stefanny Muchtar

Training Program in Surgery, Department of Surgery, Faculty of Medicine, Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital Jakarta.

Follow this and additional works at: <https://scholarhub.ui.ac.id/nrjs>

Recommended Citation

Putranto, Agi S. and Muchtar, Stefanny (2018) "Anastomosis in Intestinal Tuberculosis: A Systematic Review," *The New Ropanasuri Journal of Surgery*. Vol. 3 : No. 2 , Article 6.

DOI: 10.7454/nrjs.v3i2.53

Available at: <https://scholarhub.ui.ac.id/nrjs/vol3/iss2/6>

This Article is brought to you for free and open access by the Faculty of Medicine at UI Scholars Hub. It has been accepted for inclusion in The New Ropanasuri Journal of Surgery by an authorized editor of UI Scholars Hub.



Anastomosis in Intestinal Tuberculosis: A Systematic Review

Agi S. Putranto,¹ Stefanny Muchtar.²

1) Division of Digestive Surgery 2) Training Program in Surgery, Department of Surgery, Faculty of Medicine, Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital Jakarta.

Email: Agi_digestive@yahoo.com Received: 21/Aug/2018 Accepted: 12/Sep/2018 Published: 20/Oct/2018

<http://www.nrjs.ui.ac.id> DOI: 10.7454/nrjs.v3i2.53

Abstract

Introduction. The heterogeneity of manifestations in intestinal tuberculosis requires different approach. One step or two steps surgical procedure referred to the method of choice to reduce morbidity and mortality. The review aimed to find out the indication to perform primary anastomosis in intestinal tuberculosis.

Method. A systematic review was conducted in accordance with PRISMA guideline in June 2018. Literature searches were performed through online databases sites (PubMed, EBSCO, and Ovid) using keywords “intestinal tuberculosis” AND “surgery” AND “anastomosis”. Intestinal pathology, surgical procedures, anastomosis leaks, enterocutaneous fistula, and mortality were the variables of outcome have been analyzed.

Results. Twelve articles of cohort studies were critically appraised and analyzed. The selection of the surgical procedure depends on condition, extent disease, nutritional status, and surgeon’s preferences. Resection and primary anastomosis are safe in an obstructive lesion with low incidence of enterocutaneous fistula and anastomosis leaks. The two steps procedure is advisable in intra-abdominal sepsis.

Conclusion. In subjects without intra-abdominal sepsis, intestinal resection with primary anastomosis as a definitive procedure might be considered in obstructive lesions and in perforated lesions, with low risk to have anastomosis leaks and enterocutaneous fistulas. In contrast, in septic subjects, two steps procedure is advisable.

Keywords: *intestinal tuberculosis, anastomosis, complication*

Introduction

Tuberculosis (TB) remains an infectious disease with high mortality rate worldwide and has been declared as a global emergency by World Health Organization, as TB referred to 9th leading cause of death worldwide. It is estimated about 10.4 million population have been infected with TB, about 56% of infected population were live in India, Indonesia, China, Philippines, and Pakistan.¹ Extrapulmonary tuberculosis contributes a major problem in TB, particularly intestinal tuberculosis that takes the 6th rank of the most common extrapulmonary TB. Intestinal TB contributes 65–78% of all abdominal TB,² manifested in either ulcerative, hypertrophic ulcerative, and fibrous stricturing type. The entity mimics common intestinal disorders, particularly inflammatory bowel disease, colonic malignancy, or other gastrointestinal infections.

Intestinal TB usually runs an indolent course and late presented with complications. The complications are especially acute or subacute intestinal obstruction due to mass (tuberculoma) or stricture formation in the small intestines particularly ileocecal region. and intestinal perforation leading to peritonitis. In the obstructive lesion, right hemicolectomy with ileotransverse anastomosis is the most common surgical procedure proceeded, followed by segmental resection completed with end-to-end anastomosis, adhesiolysis, bypass surgery, ileostomy, and stricturoplasty.³

The procedure recommended on perforated intestinal TB which is primary intestinal resection frequently lead to stenosis. Even though the procedure is an ideal one, it is not feasible to be applied in cases with poor physiological function and extent disease.⁴ Therefore,

options of surgical procedures were found in vary, including drainage, resection and diversion, or resection and anastomosis, based on intraoperative findings.^{5–6}

Primary anastomosis is avoided in those cases mentioned. Complications of surgical intervention on inflamed as well as adhered tissue which is common in intestinal TB is a logic consequence. In this case, anastomosis leaks and enterocutaneous fistula, thus increase the morbidity and mortality.

A two steps procedure have been widely performed on perforated intestinal TB. The first procedure is resection and diversion either using stoma or exteriorization of perforated segment. The second procedure i.e. closure of stoma is proceed as the patient stable and antituberculosis treatment has been completed. Currently, there are no standardized procedure and or guideline on emergency surgical treatment for intestinal TB. This review aimed to find out the best option supported by the highest evidence on emergency surgical treatment in obstructed and/or perforated intestinal TB.

Method

This systematic review was conducted in the Department of Surgery, FKUI–RSCM Digestive Surgery Division, June 2018 accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline. Literature searches were performed through online databases sites (PubMed, EBSCO, and Ovid) using keywords “intestinal tuberculosis” AND “surgery” AND “anastomosis”. Selected literatures were filtered through an

advanced search, based on the type of study, full text availability, year of publication, and language, full text availability, English, published within the last 20 years, adults (>18-year-old). The excluded articles were correspondence, editorial or commentary, and articles that did not discuss the outcomes (namely enterocutaneous fistula, anastomotic leakage, and mortality). Duplications of literature were set aside. All articles were critically appraised using critical appraisal checklist for systematic review.

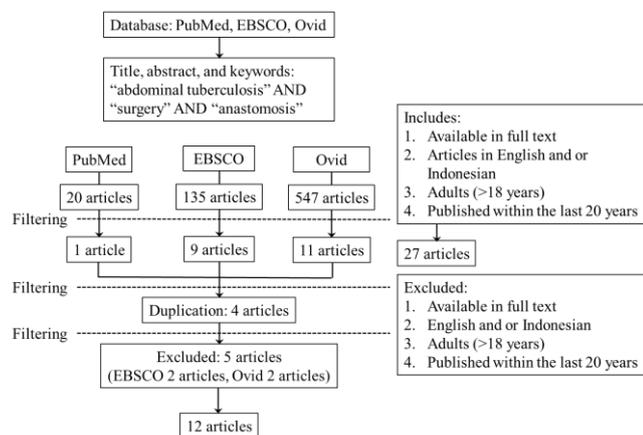


Figure 1. Diagram of literature search on intestinal tuberculosis

Results

Out of 704 articles (PubMed 20 articles, EBSCO 135 articles, Ovid 547 articles), there were 12 articles analyzed (see Figure 1). Data extraction were summarized on table 1.

Discussion

All studies in these articles are cohort studies with level of evidence (LoE) 3. Thus, this review provides that level of evidence. These studies present a variation of manifestation of intestinal TB, namely, intestinal obstruction with stricture and adhesion, as well as perforation with peritonitis. The problem encountered depends on pathological site and the extent of the disease, nutrition and patients' condition, expertise availability, local protocols and surgeon's preferences. Thus, the choice of surgical procedure is based on the problem encountered. The most surgical intervention indicated to remove the focus of infection and to treat the mechanical impacts leading to morbidity. There are surgical procedures were carried out including segmental resection of the affected segment, right hemicolectomy, band and adhesion release, repair of perforated area, stricturoplasty, exteriorization of the perforated loop, or creating stoma. The procedure of right hemicolectomy is proceeded in ileocecal involvement i.e. stricture or tuberculoma. Segmental small intestinal resection and primary anastomosis is indicated in multiple ileal strictures or long tubular stricture. The pathologic stricture segment is removed with low potency of leakage and fistula formation. In cases with diffuse peritonitis and severe sepsis, ileostomy following segmental resection or exteriorization of perforated segment is a safe procedure rather than a primary anastomosis.¹⁶

In many studies of intestinal TB, it has been shown that immediate surgery is indicated in those with intestinal obstruction. The incidence of acute obstruction is quite high, ranged of 65.1%¹³ to 72%¹⁰ caused by strictures, either a single or multiple stricture. Studies showed that

23.4%¹¹ to 33.3%¹² subjects were having strictures; both single or multiple in small intestine as the most affected site. Further, studies showed that ileocecal is the most intestine affected, even though other studies showed the ileal region.^{4,16,14,12}

Previous studies showed the widely use of one step procedure of resection with primary anastomosis in management intestinal obstruction with strictures. Study of Rajput et al⁷ and Chalya et al³ carried out right hemicolectomy and primary ileotransverse anastomosis. All subjects were treated with 1-year antituberculosis regimen. Two-steps procedure is the most preferred method in the management of intestinal TB with peritonitis caused by intestinal perforation. Intra-abdominal sepsis due to fecal contamination is the basic consideration for a direct anastomosis. Islam et al¹⁵ refuses the concept of primary anastomosis in those with edematous bowel and hypoalbuminemia. In the study of Afridi et al., the surgical procedure of choice in diffuse peritonitis is abdominal washout with stoma creation. This procedure is less surgical burden is reported successfully treated in toxic subjects as life-saving procedure in emergency setting.¹⁴ The reversal procedure should be delayed after 10–12 weeks antituberculosis treatment.

Study of Bali et al showed that ileal perforation is the most common finding,⁸ the most procedure proceeded is ileostomy. The study reported that out of twelve subjects with resection and anastomosis, there were 3 subjects with anastomosis leaks.

Enterocutaneous fistula and mortality as the outcome is not conclusive as former studies were not specifically focused on the anastomosis, and the design of these studies in not comparative. However, it was noted that the incidence of enterocutaneous fistula is 0.06–10.7%. In primary anastomosis following intestinal obstruction, Chalya et al.³ reported that enterocutaneous fistula found in 10.7% subjects and burst abdomen in 7.1% with no anastomosis leaks, while as Rajput et al. found enterocutaneous fistula in 3.52% subjects with no anastomosis leaks. In the study, it has been reported that the ileostomy proceeded in management of enterocutaneous fistula in four subjects, two subjects were successfully managed with conservative treatment, and the other two subjects were not survived due to high output stoma.⁷ Akbar et al.¹¹ reported that enterocutaneous fistula found in 6.66% following stricturoplasty with end-to-end anastomosis. Anastomosis leaks found in a subject who underwent bypass anastomosis for a severe adhesion, as resection is not possible to proceed. Pathak et al.¹³ reported one enterocutaneous fistula out of 49.9% resection and anastomosis. Charokar et al.¹⁶ found no anastomotic leakage in primary perforation repair. There was 2.6% enterocutaneous fistula. Perforations were managed by primary anastomosis in 33.2 % subjects and primary sutured in 16.6% subjects, in diffuse peritonitis, temporary ileostomy is the method of choice.

Pathak et al reported the procedure of anastomosis in 83.8% subjects with no leakage. In this study, 61.2% subjects presented with obstruction and 29% with peritonitis.¹³ On the study of Afridi et al, only 16% subjects treated with anastomosis and found 12.5% subjects with anastomosis leaks.¹⁴ On study of Islam et al, out of 37 subjects with peritonitis and ten subjects with frozen abdomen, three subjects treated with anastomosis and all were found leaks.¹⁵

Mortality were in range of 2.3% to 34.4%. Chalya et al.³ revealed that the predictors of mortality in intestinal TB were the comorbid (OR = 4.5, 95% C.I. (2.5– 8.9), p = 0.001), delayed presentation (OR = 11.3, 95% CI (7.9– 18.4), p = 0.023), HIV-positive [OR = 5.9, 95% CI (3.1– 8.9), p = 0.002], low CD4 count (<200 cells/ μ L) [OR = 7.0, 95% CI (3.9–10.5), p = 0.000], high ASA class [OR = 8.1, 95% CI

(5.6–12.9), $p = 0.014$], and surgical site infection [OR= 1.5, 95% CI (1.1–4.6), $p = 0.026$].

Table 1. Studies on surgical interventions in intestinal tuberculosis

Author/ Year/ Subject (n)	Study design	Presentation	Intraoperative Findings	Surgical procedure (n%)	Complication n (%)	Length of stay	LoE
Rajput et al ⁷ 2015 112	Prospective cohort without comparison	– Acute obstruction (37.5%) – Acute peritonitis (23.21%)	Ulcerostenotic (41.7%) – Perforation and ulcerostenotic (14) – Stenosis and adhesion (30.35%)	Anastomosis (100/89.2%) – Resection anastomosis small bowel (66/58.9%) – Limited right hemicolectomy (22/19.64%) – Classic right hemicolectomy (12/10.71%) – Stricturoplasty (4/3.5%). – Ileostomy (2/1.78%)	Anastomotic leakage (0) Enterocutaneous fistula (4/3.57%) Sepsis (4/3.75%) Mortality (4/3.57%) – Sepsis (delayed presentation) (2) – Enterocutaneous fistula (2)	7–14 days (62.50%) Postoperative complication: >6 weeks	3
Chalya et al ³ 2013 118	Prospective cohort without comparison	– Acute obstruction (62/51%) – Subacute obstruction (34/28.8%) – Peritonitis (16/13.6%) – Abdominal mass (6/5.1%)	– Ileocecal (57.6%) – Terminal ileum (28.8%) – Jejunum (10.2%) – Colon (3.4%) – Single or multiple stricture (72.9%) – Adhesions and bands (16.9%) – Stricture and perforation (5.1%) – Ileocecal mass (3.4%) – Enlarged lymph nodes of mesenteric (1.7%)	Anastomosis (94/79.6%) – Right hemicolectomy and ileotransverse anastomosis (55.9%) – Segmental resection and end-to-end anastomosis (23.7%), Adhesiolysis (16.9%) Ileotransverse bypass (1.7%) Ileostomy (1.8%) Stricturoplasty (1.8%)	Enterocutaneous fistula (6/10.7%) Burst abdomen (4/7.1%) Intra-abdominal abscess (4/7.1%) Mortality (28.8%) due to – Delayed presentation – HIV-positive – Low CD4 – High ASA – Complication	Median 24 days	3
Bali et al ⁸ 2017 76	Retrospective cohort without comparison	Peritonitis (43/56.6%) Acute obstruction (33/43.4%)	Ileal perforation (23/30.3%) Multiple small intestine perforations (14/18.4%) Solitary stricture with perforation (9/11.8%) Ileocecal mass (9/11.8%) Adhesions and bands (7/9.2%) Single or multiple strictures (5/6.6%) Stricture with impending perforation (5/6.6%) Jejunal perforation (4/5.3%)	Anastomosis (20/26.3%) – Resection and anastomosis (12) – Right hemicolectomy (8) Ileostomy (32) Primary repair of perforation (10) Adhesiolysis (6) Stricturoplasty (4) Jejunostomy (3) Peritoneal and omental biopsy (1)	Anastomotic leakage (3) (15% of total anastomotic procedure) Enterocutaneous fistula (4) Mortality (11/14.5%) → (sepsis, shock, two of them due to anastomosis leaks		
Arif et al ⁹ 2008 48	Prospective cohort without comparison	Subacute obstruction (23/46%) Acute obstruction (13/26%) Peritonitis (12/24%) Abdominal mass (2/4%)	Lesion on the gut and associated lymph nodes with or without peritoneum involvement (42/84%) Plastic-type tuberculous peritonitis (14/28%) Perforation proximal to the obstruction (14/28%)	Anastomosis (30/62.5%) – Right limited hemicolectomy and ileostomy (5/10%) – Small bowel resection and ileo-ileal anastomosis (16/32%) – Right limited hemicolectomy and ileo- colic anastomosis (14/30%) Ileal resection and ileostomy (3/6.25%) Stricturoplasty (4/7.5%) Biopsy (4/7.5%)	Enterocutaneous fistula (0%) Anastomosis leaks (0%) Subacute mortality (0%) Obstruction (4%) Prolapsed stoma (2%)		3
Baloch et al ¹⁰ 2008 86	Retrospective cohort without comparison	Acute obstruction and subacute (72%) Right lower abdomen mass (27.9%)	Distal ileum (59.3%) Ileocecal (37.2%) Jejunum (3.8%) Stricture (45/52.3%) Ileocecal mass (24/27%)	Stricturoplasty (47.6%) Right hemicolectomy (30.2%) Loop ileostomy (16.2%) Primary suture (5.8%)	Anastomotic leakage (0) Abscess residue (13.9%) Wound dehiscence (5) Sepsis due to chest infection and wound infection (4)		3

Author/ Year/ Subject (n)	Study design	Presentation	Intraoperative Findings	Surgical procedure (n%)	Complication n (%)	Length of stay	LoE
		Peritonitis and abdominal free air (19.8%)	Perforation of the gut (17/19.8%) – ileocecal (8) – terminal ileum (6) – jejunum (3)		Mortality (2.3%)		
Akbar et al ¹¹ 2010 30	Prospective cohort without comparison	Acute obstruction	Stricture (15/50%) Stricture of small bowel (10/33.3%) consisting of: – Multiple stricture at jejunum and ileum (6) – Single stricture at terminal ileum (2) – Stricture at terminal ileum with perforation proximal to the stricture (2/6.66%) Ileocecal tuberculosis (12/40%) Adhesion and band adhesion (3/10%)	Anastomosis (11/36.3%): – Segmental resection and end-to-end anastomosis (4/13.33%) – Right hemicolectomy (3/10%) – Limited right hemicolectomy (3/10%) – Right hemicolectomy and segmental resection (1/3.33%) – Limited right hemicolectomy and stricturoplasty (1/10%) Adhesion and bands lysis (4/13.33%) Bypass (1/3.33%) Stricturoplasty (11/36.33%) Loop ileostomy (2/6.66%)	Enterocutaneous fistula (2/6.66%) Anastomotic leakage (1.9% of total anastomosis) Intra-abdominal abscess (2/6.66) Mortality (3/10%) – Uncontrolled sepsis (2) – Anastomotic leakage (1)	7–45 days	3
Mukhopadhyay et al ¹² 2014 70	Prospective cohort without comparison	Bowel obstruction (33/47.1%) Peritonitis perforation (22/31.4%) Acute appendicitis (7/10%) Abdominal pain and mass (3/4.3%) Abdominal pain and ascites (5/7.2%)	Single or multiple stricture in the small gut (15/23.4%) Hypertrophic variants in ileocecal region (14/21.9%) Small gut perforation with single or multiple distal strictures (9/14.1%) Small bowel perforation and tubercle (5/7.8%) Appendicitis and abdominal tuberculosis (7/10.9%) Abdominal cocoon (3/4.7%) Mesenteric lymphadenopathy and caseous (3/4.7%)	– Resection and anastomosis (9.3%) – Resection and exteriorization (29.7%) – Limited right hemicolectomy (26.6%) – Stricturoplasty (6.25%) – Primary suture (3.1%) – Appendectomy (11%).	Anastomotic leakage (3/4.6%) leading to death (50% of total anastomosis) Airway infection (15%) Wound infection (10%) Sepsis (7%) Mortality 5% (Sepsis and multiorgan dysfunctions)		3
Pathak et al ¹³ 2016 31	Prospective cohort without comparison	Obstruction (20/64.51%) Peritonitis (9/29.03%) Bleeding from rectum (1/3.22%) Appendicitis (1/3.22%)	Obstruction – Ileocecal mass (12/60%) – Thickening of distal ileum (3/15%) – Ileocecal stricture (1/5%) – Ileal stricture with duodenal fistula (1/5%) – Flexure hepatic colon stricture (1/5%) – Mass on hepatic flexure (1/5%) Perforation – Ileal perforation (4/44.4%) – Ileal perforation distal to the stricture (2/22.2%) – Gangrene on ileal segment of ileum (1/11.1%) – Perforation with ileocecal mass (1/11.1%) Perforation in mid jejunum (1/11.1%)	Anastomosis (26/83.8%): – Right hemicolectomy (11/35.48%) – Right limited hemicolectomy (4/12.90%) – Resection and anastomosis ileoileal (2/6.4%) – ileo-ileal resection anastomosis + stricturoplasty (1/3.2%) – Colo-colic resection anastomosis (1/3.2%) – Ileotransverse anastomosis (1/3.2%) – Right extended hemicolectomy (1/3.2%) – Jejunum-jejunal resection anastomosis (1/3.2%) – right hemicolectomy with stricturoplasty (1/3.2%) – ileo-ileal anastomosis + loop ileostomy (4/19.35%)	Wound dehiscence (1) Enterocutaneous fistula (1) Bowel obstruction (1) Wound infection (1) Parastomal hernia and prolapsed stoma (1) Mortality (3,2%)	–	3

Author/ Year/ Subject (n)	Study design	Presentation	Intraoperative Findings	Surgical procedure (n%)	Complication n (%)	Length of stay	LoE
				– anastomosis ileo-ileal + end ileostomy (2/33.33%)			
Afridi et al ¹⁴ 2016 100	Prospective cross-sectional without comparison	Peritonitis (61%) Acute bowel obstruction (24%) Ileocecal mass (7%) Enterocutaneous fistula (5%) Subacute bowel obstruction (3%).	Multiple ileal strictures (13%) Ileal stricture and perforation (10%) Multiple ileal perforation (8%) Single ileal perforation (3%) Jejunum stricture (6%) Multiple jejunal perforation (3%) Single jejunal perforation (3%) Jejunal and ileal adhesions (4%) Jejunal and ileal perforation with stricture (3%) Jejunal and ileal perforation (1%) Multiple ulcer on large bowel with stricture and perforation (9%) Rectum (1%) Small bowel and large bowel perforation (6%) Perforation and stricture (2%) Tubercles in whole abdomen (1%)	Anastomosis (16%): – Limited hemicolectomy and anastomosis (7%) – Primary suture and anastomosis (9%) Stoma (34%) Limited hemicolectomy and stoma (14%) Segmental resection and stoma (12%)	Leakage anastomosis (12.5% of total anastomosis) Wound dehiscence (20%) Hernia incisional (20%) Burst abdomen (13%) Stoma retraction (3%) Mortality (18%)	–	3
Islam et al ¹⁵ 2011 49	Prospective cohort without comparison	Peritonitis (37/75.5%) Obstruction (12/24.5%)	Small bowel stricture (50%) Obstruction (7/14.2%) Ileal perforation (13/26.5%) Mass (19/38.7%) Frozen abdomen (10)	Resection anastomosis (3) Small bowel resection (11) Right hemicolectomy (8) Biopsy (30) Anastomosis (2) Stoma (18)	Enterocutaneous fistula (3) Anastomotic leakage (3) (100% of total anastomosis) Mortality 34.4%	14	3
Charokar et al ¹⁶ 2017 72	Prospective cohort without comparison	Bowel obstruction (29/40.2%) Perforation peritonitis (18/25%) Abdominal mass (25/34.7%)	Perforation (24/ 33.3%) – Ileum (23/91.7%) – Colon (1/1.3%) Stricture (21/29.1%) – Ileum (23/26%) – Jejunum (2/2.7%) Adhesions and bands (18/25%) Ileocecal mass and thickening of mesenteries (14/19.4%) Adhesion of peritoneum with abdominal cocoon (6/8.3%)	Anastomosis (24/33.3%): – Right hemicolectomy and primary anastomosis (14/19.4%) – Primary anastomosis (12/16.6%) – Segmental resection with primary anastomosis (10/13.8%) Segmental resection with ileostomy (9/12.5%) Adhesiolysis and band release (22/30.5%) Perforation repair of the colon with ileostomy (1/1.3%)	Anastomotic leakage (0%) Sepsis (8/11%) Intra-abdominal abscess (5.5%) Wound dehiscence (2/2.6%) Enterocutaneous fistula (2/2.6%) after reverse stoma Mortality (2.6%) due to multiorgan dysfunction	4-45 days Median 14 days	3

The highest mortality rate (34.3%) found in the study of Islam et al. and found to have anastomosis leaks.¹⁵ Anastomosis leaks contributes as factor increasing the morbidity and mortality. Hence, a decision to perform primary anastomosis need to be considered carefully

Conclusion

In subjects without intra-abdominal sepsis, intestinal resection with primary anastomosis as a definitive procedure might be considered in obstructive lesions and in perforated lesions, with low risk to have anastomosis leaks and enterocutaneous fistulas. In contrast, in septic subjects, two steps procedure is advisable. The mortality in intestinal TB is associated with sepsis, delayed presented and extent disease.

Conflict of interest

Author disclose there was no conflict of interest.

References

1. World Health Organization. Global Tuberculosis Report 2017. World Health Organization Report 2017. 2017.
2. Vigneswara KV, Gen RMS, Rao KS, Surgery MSG. Surgical Study of Abdominal Tuberculosis. *J Dent Med Sci*. 2016;15(6):32–5.
3. Chalya PL, Mchembe MD, Mshana SE, Rambau P, Jaka H, Mabula JB. Tuberculous bowel obstruction at a university teaching hospital in Northwestern Tanzania: A surgical experience with 118 cases. *World J Emerg Surg*. 2013;8(1):1.
4. Kakar A, Aranya RC, Nair SK. Acute Perforation of Small Intestine Due To Tuberculosis. *Aust N Z J Surg*. 1983;53(4):381–3.
5. Ara C, Sogutlu G, Yildiz R, Kocak O, Isik B, Yilmaz S, et al. Spontaneous small bowel perforations due to intestinal tuberculosis should not be repaired by simple closure. *J Gastrointest Surg*. 2005;9(4):514–7.
6. Coccolini F, Ansaloni L, Catena F, Lazzareschi D, Puviani L, Pinn AD. Tubercular bowel perforation: what to do? *Turkish J Trauma Emerg Surg*. 2011;17(1):66–74.
7. Rajput M, Memon A, Rani S, Memon A. Clinicopathological profile and surgical management outcomes in patients suffering from intestinal tuberculosis. *JLUMHS*. 2005;4(3):113–8.
8. Bali RS, Jain R, Zahoor Y, Mittal A. Abdominal tuberculosis : a surgical emergency Original Research Article Abdominal tuberculosis: a surgical emergency. *Int J Res Med Sciences*. 2017;5(9):3849.
9. Arif AU, Shah LA, Asadullah A, Sadiq M. The frequency and management of intestinal tuberculosis; a hospital-based study. *J Postgrad Med Inst*. 2008;22(2):152–6.
10. Baloch NA, Baloch MA, Baloch FA. A Study of 86 Cases of Abdominal Tuberculosis. *J Surg Pakistan*. 2008;13(1):3–5.
11. Akbar M, Fakhar-ul-Islam, Haider IZ, Naveed D, Akbar I, Khattak I, et al. Surgical management of tuberculous small bowel obstruction. *J Ayub Med Coll Abbottabad*. 2010;22(2):171–5.
12. Mukhopadhyay A, Dey R, Bhattacharya U. Tuberculosis with an acute abdomen: Our clinical experience. *J Clin Diagnostic Res*. 2014;8(7):24–6.
13. Pathak P, Sahu SK, Agrawal S. Clinico-Pathological Profile and Surgical Outcome of Patients of Gastrointestinal Tuberculosis Undergoing Laparotomy. *Chirurgia (Bucur)*. 2016;(6):487–92.
14. Afridi SP, Siddiqui RA, Rajput A. Spectrum of abdominal-tuberculosis in emergency surgery: 100 cases at a tertiary care Centre Dow University of Health Sciences and Civil Hospital Karachi, Pakistan. *J Pak Med Assoc*. 2016;66(9):1173–5.
15. Islam J, Clarke DL, Thomson SR. Lessons from emergency laparotomy for abdominal tuberculosis in the HIV/AIDS era. *South African J Surg*. 2014;52(1):10–2.
16. Charokar K, Garg N, Jain AK. Surgical management of abdominal tuberculosis : a retrospective study from Central India. 2016;3(1):23–31.