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# Factors affecting the morbidity and mortality in patients of secondary peritonitis- An analytical observational study

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#### ABSTRACT

Background: Peritonitis is defined as inflammation of the peritoneal cavity. It may be localized or generalized. Secondary peritonitis is due to perforation of the gastro- intestinal tract is one of the most common surgical emergencies all over the world. Smoking, use of non-steroidal anti-inflammatory drugs, chronic Helicobacter pylori infection, excessive alcohol, coffee, and stress are important risk factors for perforation.

Material and Method: The study was conducted in Department of Surgery, NKPSIMS & LMH between the period of October 2018 to October 2020. A total of 104 patients with non-traumatic secondary peritonitis were included in the study after taking informed consent and ruling out the exclusion criterion. Pre-operative history and intra-operative findings were noted. Post-operative complications and number of hospital-stay days was noted.

Result: Mean age of presentation with complication was 45.12 +/- 2.36 yrs and without complications 41 +/- 1.65. Male predominantly involved with 78 in number. Male: female ratio- 3:1. High BMI associated with more morbidity and mortality.

Smoking, alcohol, diabetes mellitus and hypertension were important risk factors in complication group. Maximum complication rate is in patients presented between 24 to 72 hours, >24 hours presentation is a significant p value. Dyselectrolytemia, low haematocrit values were important lab parameters in complication group. On Chest Xray, gas under diaphragm was seen in 93.27% on patients (n=97). For most of the patients(89.42%, n=93), an open exploratory laparotomy was performed and diffuse peritonitis was found in 58.65% of patients (n=61). The most common site of perforation was gastro-duodenal (60.58%, n=63), but maximum number of complications were observed in large bowel perforation.Complication was observed in 41 patients (39.42%), most common complication was respiratory infection (n=30). Mortality rate was observed as 7.69% (n=8). Average number of days spent in hospital was 10 days, but patients with complication had higher hospital stay with average of 12 days.

## **Keywords**: secondary peritonitis, absolute eosinophilic count, complications, morbidity, mortality **INTRODUCTION**

Peritonitis is defined as inflammation of the peritoneal cavity. It may be localized or generalized <sup>(1)</sup>. Secondary peritonitis is due to perforation of the gastro- intestinal tract is one of the most common surgical emergencies all over the world<sup>(2)</sup>. Smoking, use of non-steroidal anti-inflammatory drugs, chronic

Helicobacter pylori infection, excessive alcohol, coffee, and stress are important risk factors for perforation<sup>(1)</sup>

Early prognostic evaluation of peritonitis is desirable to provide objective classification of the severity of

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the disease and select high- risk patients for more aggressive therapeutic procedures but this has been affected by late presentation to the health facilities by majority of patients, a situation which further complicates effective management<sup>(3)</sup>.

The prognosis and outcome of peritonitis depend on the complex interaction of many factors patient related, disease related and intervention related. The chronic health status is also noted to influence the outcome<sup>(4)</sup>.

Whittman (1996)<sup>(5)</sup> demonstrated that age, duration of symptoms, white cell count, mechanisms and origin of infection are related to outcome.

To establish the effects of various factors acting on the morbidity and mortality, an extensive research has been done in Western population but could not find the overall impact of various variables on the outcome of peritonitis. So, it's worthwhile to plan a study on Indian population with secondary peritonitis. This study is an attempt to evaluate the influence of factors on morbidity and mortality of patients admitted with secondary peritonitis and evaluates their statistical significance in Indian population.

#### AIMS & OBJECTIVES:

Aim of the study is to study the association between demographic and peri-operative factors on mortality and morbidity of the patients of secondary peritonitis.

The objectives are as follows:

- 1. To study the demographic factors namely age, gender, BMI, smoking, alcohol consumption, past history of hypertension, diabetes mellitus, tuberculosis, any cardiac abnormality, malignancy, chronic use of NSAIDs (> 3 months) as predictors for morbidity and mortality in patients of nontraumatic secondary perforation.
- study the clinical 2. factors To namely tachycardia, mean arterial pressure (MAP), oxygen saturation, abdominal tenderness, abdominal guarding. abdominal rigidity, abdominal distension, duration of vomiting, constipation presentation, as predictors for morbidity and mortality in patients traumatic of nonsecondary perforation.

3. To study the laboratory findings namely haematocrit value, total leucocyte count, absolute eosinophilic count, serum creatinine, serum potassium, as predictors for morbidity and mortality in non-traumatic acute secondary perforation peritonitis.

4. To study peri-operative and post-operative findings namely type of operation, organ of perforation, number of perforation, type of peritoneal fluid, post-operative complications like surgical site infection, respiratory infection, shock, renal failure, burst abdomen, DVT, and total number of days in hospital as predictors of morbidity and mortality in patients of non-traumatic secondary peritonitis.

#### **MATERIAL & METHOD**

This analytical observational study was conducted in NKPSIMS, Lata Mangeshkar Hospital, Nagpur from October 2018 to October 2020. Patients presenting to the casualty with acute abdomen were evaluated by clinical examination and radiological imaging ( Chest X-Ray PA view, CT Scan) to establish a diagnosis of secondary peritonitis. Patients between age group of 18 years to 80 years were included in this study. Patients with other causes of acute abdomen like acute appendicitis, acute cholecystitis, ectopic pregnancy etc. were excluded from the study. A written and informed consent was taken before inclusion and those denying consent were excluded from the study. A detailed history of the patients including demographic details, BMI, socioeconomic status was taken. Baseline general examination and local examination of breast was done before subjecting the patient for laparotomy/ laparoscopy.

Peri-operative findings were noted, including organ of perforation, number of perforation, extent of peritonitis, type of fluid( clear/ purulent/ feaculant). Post-operative complications were noted and number of days admitted in hospital was recorded. Statistical analysis was done by Student T Test for continuous data, for categorical data Chi Square test and Fisher Test was applied. All the data was studied using epi info 7 (version 6) software.

#### RESULT

A total number of 104 patients fulfilling the inclusion and exclusion criteria were enrolled prospectively. The results are as follows:

#### Age

The mean age of the enrolled patients was  $42.62 \pm 13.92$  years with a range from 19 years to 83 years. Maximum number patients (32, 30.77%) presented in the age group of 30-39 years. Mean age of patients

with complications (n= 41):  $45.12 \pm 2.36$  years. Mean age of patients without complications (n= 63) :  $41 \pm 1.65$  years. Age as an factor for morbidity and mortality did not have a significant p value (p-0.143).

Age group (years)	Number (n)	%	Complications Number %	
18-30	18	17.31	8	44.44
>30- 40	32	30.77	7	21.88
>40- 50	22	21.15	8	36.36
>50- 60	19	18.27	11	57.89
>60- 70	9	8.65	6	66.67
>70-79	2	1.92	0	0.0
80 & above	2	1.92	1	50.0
Total	104	100	41	39.42

#### Table 1: showing age group and its relation to morbidity and mortality

#### Gender

Of the 104 patients enrolled 78 (75%) were males and 26 (25%) were female. The male to female ratio was 3:1. Total number of male patients with complication was 29 and total number of female patients with complication was 12. Gender as an factor for morbidity and mortality did not have a significant p value (p- 0.417)

#### **Body Mass Index**

The average BMI of all 104 patients enrolled was 22.56  $\pm$  2.86. Mean BMI of patients with complications (n = 41) was 24.27  $\pm$  3.52. Mean BMI of patients without complications (n = 63) : 21.86  $\pm$  1.92. Morbidity and mortality was significant (p-0.001) in patients with BMI > 30.

Table 2: showing BMI and its relation to a	morbidity and mortality
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BMI	Number	%	Complications Number %		P value
< 18.5	11	10.58	5	45.45	0.601
18.5-22.9	53	50.96	20	37.74	0.884
23.0-24.9	21	20.19	11	52.38	0.260
25.0-29.9	18	17.31	4	22.22	0.135
30 & above	1	0.96	1	100.0	0.001*
Total	104	100	41	39.42	0.242

#### **Co-Morbidity**

Diabetes mellitus, hypertension, bronchial asthma, tuberculosis, any cardiac disease, immune-compromised state, presence of malignancy, tobacco use, alcohol consumption and consumption of NSAIDS over 3 months of duration were the various co-morbidity factors studied. Total patients with any one or more of the above mentioned comorbid factors was 74.04% (n = 77). Most common comorbidity was alcohol consumption (n = 55) followed by smoking/ tobacco chewing (n = 42) and hypertension (n = 32). Complication rate amongst patients with comorbidity was 50.65% (n = 39). Complication rate in patients without any co-morbidity was 7.41% (n = 2)

Comorbidity	Number	%	Complications Number %		P value
Present	77	74.04	39	50.65	
Absent	27	25.96	2	7.41	0.001*
Total	104	100	41	39.42	

Table 3:	showing	various	co-morbidities a	and its r	elation t	o morbidity	and	mortality	

#### **Clinical Signs and Symptoms**

Pain in abdomen was observed in all 104 patients. Fever associated with pain was observed in 77 (74.01%) patients. Vomiting was observed in 59 (56.73%) patients and abdominal distension was observed in 24 (23.04%). Abdominal tenderness present in 101 patients (97.12%). Guarding was present in 88 patients (84.62%) and abdominal rigidity was found in 63 patients (60.58%). Bowel sound was absent in 18 patients (17.30%)

#### **Duration of Pain**

Most commonly observed duration of pain was 6-24 hours seen in 48 patients (46.15%) with a complication rate of 22.91% (n = 11). Duration less than 6 hours was found in 25 patients (24.04%) with complication rate of 32% (n = 8). Duration of pain between 24-72 hours was observed in 19 patients with a complication rate of 73.68% (n= 14). Duration of pain more than 72 hours was observed in 12 patients with complication rate of 66.67% (n = 8). Duration of pain is more than 24 hours is a significant factor contributing to morbidity and mortality in patients of perforation peritonitis (p value- 0.03).

Table 4:	showing	duration of	f pain and	l its relation	to morbidity	and mortality
			- F			

Duration of pain	Number	%	Complica Number	ations %	P value
Less than 6 hours	25	24.04	8	32.0	0.072
6-24 hours	48	46.15	11	22.91	0.09
24- 72 hours	19	18.27	14	73.68	0.039*
More than 72 hours	12	11.54	8	66.67	0.022*
Total	104	59.61	41	39.42	

#### **Clinical Vitals**

Average pulse rate observed in all patients (n = 104)was  $108.23 \pm 13.08$  beats/min with a minimum pulse rate of 78 beats/ min and maximum pulse rate of 132 beats/ min. mean pulse rate in patients without complication (n = 63) was  $106.60 \pm 11.53$  beats/ min and mean pulse rate in patients with complication (n = 41) was 108.23 ± 13.08 beats/min. Average respiratory rate observed in all patients (n = 104) was  $22.32 \pm 2.85$  /min with a minimum respiratory rate of 16/ min and maximum respiratory rate of 28/ min. mean respiratory rate in patients without complication (n = 63) was 22.46  $\pm$  2.59 / min and mean respiratory rate in patients with complication(n = 41) was  $22.10 \pm 3.22$  / min. Average mean arterial pressure (MAP) observed in all patients (n = 104)was  $78.54 \pm 12.40$  mmHg with a minimum mean arterial pressure of 60 mmHg and maximum mean arterial pressure of 114 mmHg. mean MAP in patients without complication (n = 63) was 78.89  $\pm$ 11.43 mmHg and mean MAP in patients with complication (n = 41) was  $78.02 \pm 13.83$  mmHg. Average oxygen saturation observed in all patients (n = 104) was 96.62  $\pm$  2.20 % with a minimum oxygen saturation of 90% and maximum oxygen saturation of 100%. Mean oxygen saturation in patients without complication (n = 63) was 96.83  $\pm$  1.72% and mean oxygen saturation in patients with complication (n =41) was

 $96.29 \pm 2.77\%$ .

Neither of the clinical vitals were a significant factor in predicting morbidity and mortality in patients of secondary peritonitis.

#### Laboratory Investigation

#### **Hematocrit Value**

Mean Hematocrit value in all patients (n = 104) was  $37.63 \pm 4.08\%$ . The haematocrit value ranged from 29% to 48%. Mean hematocrit value of patients without complication (n = 63) was  $38.3 \pm 3.67\%$ . Mean hematocrit value of patients with complication (n = 41) was  $36.59 \pm 4.5\%$ . it is not of significance in predicting morbidity and mortality in patients of secondary peritonitis (p- 0.036). (Table 9)

#### **Total Leucocyte Count**

Mean Total leucocyte count (TLC) in all patients (n = 104) was  $9580 \pm 4003$ / cumm. Total leucocyte count ranged from 1200/cumm to 23000/cumm. Mean TLC of patients without complication was

 $9580 \pm 3520$ /cumm. Mean TLC of patients with complication =  $9310 \pm 4380$ /cumm. it is of significance in predicting morbidity and mortality in patients of secondary peritonitis (p- 0.036). (Table 9)

#### **Serum Creatinine**

Mean Serum creatinine value in all patients (n = 104) was  $1.48 \pm 0.67$  mg/dl. Serum creatinine level ranged from 0.4 mg/dl to 4.2 mg/dl. Mean serum creatinine value of patients without complication (n = 63) was  $1.4 \pm 0.56$  mg/dl. Mean serum creatinine value of patients with complication (n = 41) was  $1.6 \pm 0.8$  mg/dl. it is not of significance in predicting morbidity and mortality in patients of secondary peritonitis. (Table 9)

#### Serum Sodium

Mean serum sodium value in all patients (n = 104) was  $136.33 \pm 3.56$  mEQ/L. It ranged from 128 mEQ/L to 146 mEQ/L. Mean serum sodium of patients without complication (n = 63) was  $136.9 \pm 3.31$  mEQ/L. Mean serum sodium of patients with complication (n = 41) was  $135.3 \pm 3.75$  mEQ/L. it is of significance in predicting morbidity and mortality in patients of secondary peritonitis (p- 0.029). (Table 9)

#### **Serum Potassium**

Mean Serum potassium value in all patients (n = 104) was  $3.56 \pm 0.36$  mEQ/L. It ranged from 2.8 mEQ/L to 4.4 mEQ/L. Mean serum potassium of patients without complication (n = 63) was  $3.67 \pm 0.34$  mEQ/L. Mean serum potassium of patients with complication (n = 41) was  $3.44 \pm 0.34$  mEQ/L. it is of significance in predicting morbidity and mortality in patients of secondary peritonitis (p- 0.001). (Table 9)

#### **Randomised Blood Sugar Level**

Mean randomised blood sugar value in all patients (n = 104) was 116  $\pm$  39 mg/dl. It ranged from 58 mg/dl to 216 mg/dl. Mean randomised blood sugar of patients without complication (n = 63) was 121  $\pm$  42 mg/dl. Mean randomised blood sugar of patients with complication (n = 41) was 109  $\pm$  35 mg/dl. It is not of significance in predicting morbidity and mortality in patients of secondary peritonitis (p-0.139).

**Absolute Eosinophilic Count** 

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Mean Absolute Eosinophilic Count in all patients was  $222 \pm 168$ . Absolute Eosinophilic Count ranged from 18 to 720. Mean Absolute Eosinophilic Count of patients without complication (n = 63) 235.03  $\pm$  152.21. Mean Absolute Eosinophilic Count of

patients with complication (n = 41) was 203.99  $\pm$  190.46. It is not a significant factor in predicting morbidity and mortality in patients of secondary peritonitis (p- 0.107).

Absolute	Obser-	Summary measures		Range	
EOS count	vations				
	( <b>n</b> )	Mean	Standard	Minimum	Maximum
			Deviation		
With complication	41	203.99	190.46	21	920
Without complication	63	235.03	152.21	18	702
Total	104	222.79	168.12	18	920

#### Chest X-ray (PA View)

Chest X-ray (posterior- anterior view) was performed in all the patients suspected of secondary peritonitis. Gas under the right dome of diaphragm was seen in 97 patients (93.22%) and was not observed in the rest patients

(n =7, 6.73%).

#### **Type of Operation**

Out of total 104 patients, 89.42% of patients (n = 93) underwent exploratory laparotomy for perforation peritonitis with complication rate of 37.63% (n = 35). Only 14.58% of patients (n = 11) underwent laparoscopic surgery with complication rate of 54.55% (n = 6). Type of operation (open vs laparoscopic) is not a significant factor in predicting the morbidity and mortality in patients of secondary peritonitis (p- 0.278)

#### **Extent of Peritonitis**

Out of total 104 patients, total number of patients with localised peritonitis was 43 (41.35%), with

complication rate of 9.3% (n = 4). Total number of patients with diffuse peritonitis was 61 (58.65%), with complication rate of 60.65% (n = 37). Extent of peritonitis is a significant factor in predicting the morbidity and mortality in patients of secondary peritonitis(p-0.005)

#### Organ of Perforation

Most common site of perforation- gastro-duodenal found in 60.58% of patients (n = 63), followed by jejuno-ileal (25.96%, n = 27), followed by appendicular perforation (6.73%, n = 7). Gall bladder perforation was seen in 3 patients (2.88%) and large bowel perforation was seen in 4 patients (3.85%). Most complications seen in large bowel perforation (75%) with significant p-value of 0.026. Hence, large bowel perforation is an predicting factor for morbidity and mortality in patients of secondary peritonitis.

Organ	Number	%	Complication Number %	ns	P value	
Gastro-duodenal	63	60.58	24	38.09	0.062	٦,-
Jejunal/ileal	27	25.96	11	40.74	0.539	_α

Table 6: showing organ of perforation and its relation to morbidity and mortality

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Appendicular	7	6.73	2	28.57	0.706
Gall bladder	3	2.88	1	33.33	0.378
Caecum/ colon/ rectum	4	3.85	3	75.0	0.026*
Total	104	100	41	39.42	0.845

#### Complication

Respiratory infection, surgical site infection, shock, renal failure and burst abdomen were the varios complications seen. Out of total 104 patients, 41 patients (39.42%) had one or more of the above mentioned complications. Most common complication was respiratory tract infection seen in 30 patients (28.85%), followed by surgical site infection seen in 23 patients (22.12%), followed by shock seen in 14 patients (13.46%). Renal failure was seen in 9 patients (8.65%) and burst abdomen was seen in 2 patients (1.92%)

**Table 7: showing post-operative complications** 

Characteristic	Number	%
SSI	23	22.12
Respiratory infection	30	28.85
Shock	14	13.46
Renal Failure	9	8.65
Burst abdomen	2	1.92

#### **Mortality Rate**

Out of 104 patients, 8 patients died (7.69%)

#### **Hospital Stay**

Average number of hospital stay days - 10.18 days. Most patients stayed for 8-14 days. Patients with complications stayed for an average of 12.26 days.

#### DISCUSSION

Peritonitis resulting from perforation of the gastrointestinal tract is a common surgical emergency in India<sup>(27)</sup>. This study had been conducted to identify the various demographic and peri-operative factors affecting the morbidity and mortality in patients of secondary peritonitis. Also, the different complications seen in post-operative patients were studied and mortality rate calculated.

Mean age of patients with non traumatic secondary peritonitis was

 $42.62 \pm 2.12$  years with male: female ratio of 3:1. Most common comorbid factor found in patients of non traumatic secondary peritonitis was smoking and tobacco consumption. Most common clinical presentation in patients of non-traumatic secondary peritonitis - pain in abdomen. Abdominal tenderness was present in 97.12% of patients (n=101), abdominal guarding was present in 84.62% of patients (n=88) and abdominal rigidity was present in 60.58% of patients (n=63). Duration of pain was most commonly 6-24 hours (46.15%, n=48) but complication rate was high when duration was more than 24 hours. The next common presenting symptom was fever (74.04%, n = 77), followed by vomiting (56.73%, n = 59). Most of the patients had tachycardia and tachypnea. Low hematocrit value, high serum creatinine, deranged serum electrolyte level (serum sodium and serum potassium) were significant laboratory investigations for predicting morbidity and mortality in patients of secondary Absolute eosinophilic countperitonitis. One distinctive aspect of acute inflammation is the rapid and persistent decrease in the number of circulating eosinophils the reason for which remains unclear. It has been postulated that the abrupt eosinopenia may

be due to the migration of eosinophils to the site of inflammation as a response to the release of chemotactic factors of inflammation into the blood stream. Absolute eosinophilic count has been seen to be on the lower end in patients with complications and in seen below normal level in patients with mortality, but the p-value was not significant in this study. The most common site of perforation was gastro-duodenal (60.58%, n=63), but maximum number of complications were observed in large bowel perforation. Complication was observed in 41 patients (39.42%), most common complication was respiratory infection (n = 30). Out of 104 patients, 8 patients died due to post-operative total complication, with mortality rate of 7.69%, Average number of days spent in hospital was 10.18 days, but patients with complication had higher hospital stay with average of 12.16 days.

Factors affecting morbidity and mortality in patients of non-traumatic secondary peritonitis are:

- 1. BMI above 30
- 2. Co-morbidities like smoking, alcohol consumption, chronic NSAID use, hypertension, diabetes mellitus, cardiac disorder, malignancy. (in this study, smoking and chronic NSAID use were the two most significant co-morbid factors)
- 3. Duration of pain more than 24 hours
- 4. Low hematocrit value, high serum creatinine, deranged serum electrolyte level (serum sodium and serum potassium)
- 5. Operative finding of diffuse peritonitis
- 6. Large bowel perforation

#### CONCLUSION

The study was conducted at a tertiary care academic teaching hospital for a period of 2 years. Factors affecting morbidity and mortality in patients of non-traumatic secondary peritonitis are: BMI above 30, Co-morbidities like smoking, alcohol consumption, chronic NSAID use, hypertension, diabetes mellitus, cardiac disorder, malignancy. (in this study, smoking and chronic NSAID use were the two most significant co-morbid factors), duration of pain more than 24 hours, low hematocrit value, deranged serum electrolyte level (serum sodium and serum

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potassium), operative finding of diffuse peritonitis and large bowel perforation.

Complication were seen in 39.42% patients. Respiratory tract infection was the most common complication seen in patients in post-operative period followed by surgical site infection. The observed mortality rate was 7.69%.

Peritonitis is one of the commonest surgical emergencies and carries high morbidity and mortality. It is necessary to recognize patients at higher risk. This becomes even more important in our setup, as the intensive care facilities are limited and overwhelmed by the number of patients.

#### **BIBLIOGRAPHY**

- 1. Townsend CM, Beauchamp RD, Evers BM, Mattox KL. Sabiston textbook of surgery Ebook. Elsevier Health Sciences; 2016 Apr 22.
- 2. Mabewa A, Seni J, Chalya PL, Mshana SE, Gilyoma JM. Etiology, treatment outcome and prognostic factors among patients with secondary peritonitis at Bugando Medical Centre, Mwanza, Tanzania. World Journal of Emergency Surgery. 2015 Dec;10(1):1-7.
- 3. Singh R, Kumar N, Bhattacharya A, Vajifdar H. Preoperative predictors of mortality in adult patients with perforation peritonitis. Indian journal of critical care medicine: peerreviewed, official publication of Indian Society of Critical Care Medicine. 2011 Jul;15(3):157.
- 4. Ibrahim EH, Sherman G, Ward S, Fraser VJ, Kollef MH. The influence of inadequate antimicrobial treatment of bloodstream infections on patient outcomes in the ICU setting. Chest. 2000 Jul 1;118(1):146-55.
- 5. Wittmann DH, Schein M, Condon RE. Management of secondary peritonitis. Annals of surgery. 1996 Jul;224(1):10.
- 6. Hertzler AE. The Peritoneum, St. Louis, CV Mosby Company. 1919;1:4.
- 7. Steinberg B. Infection of the peritoneum New York. NY: Hoeber. 1944:25-35.
- 8. James W. Dobbie, Surgical peritonitis: Its Relevance to The pathogenesis of peritonitis in CAPD, peritioneal Dialysis, International

Dr. Jyoti Gupta et al International Journal of Medical Science and Current Research (IJMSCR)

Journal of Oral and Maxillofacial Surgery, 31, 206-209Vol.8: pg 241-248: 1998

- 9. Genuit T. Peritonitis and Abdominal Sepsis" eMedicine Sep. 2004; 1-11.
- Bosscha K, van Vroonhoven TJ, Van der Werken CH. Surgical management of severe secondary peritonitis. British journal of surgery. 1999 Nov 1;86(11):1371-7.
- 11. Dani T, Ramachandra L, Nair R, Sharma D. Evaluation of prognosis in patients' with perforation peritonitis using Mannheim's peritonitis index. International Journal of scientific and research publications. 2015 May;5(5):1-35.
- 12. Williams NS, O'Connell PR, McCaskie A, editors. Bailey & Love's short practice of surgery. CRC press; 2018 Apr 27.
- Svanes C. Trends in perforated peptic ulcer: incidence, etiology, treatment, and prognosis. World journal of surgery. 2000 Mar;24(3): 277-83.
- Sandweiss DJ, Podolsky HM, Saltzstein HC, Farbman AA. Deaths from perforation and hemorrhage of gastroduodenal ulcer during pregnancy and puerperium: A review of the literature and a report of one case. American Journal of Obstetrics and Gynecology. 1943 Jan 1;45(1): 131-6.
- 15. Sanders RO. Incidence of perforated duodenal and gastric ulcer in Oxford. Gut. 1967 Feb;8(1):58.
- 16. Ellis H, Mahadevan V. Clinical anatomy: applied anatomy for students and junior doctors. John Wiley & Sons; 2013 Aug 13.
- 17. Blackburn SC, Stanton MP. Anatomy and physiology of the peritoneum. InSeminars in pediatric surgery 2014 Dec 1 (Vol. 23, No. 6, pp. 326-330). WB Saunders.
- Simmen HP, Heinzelmann M, Largiader F. Peritonitis: Classification and causes. Digestive Surgery. 1996;13(4-5):381-3.

- 19. Johnson CC, Baldessarre J, Levison ME. Peritonitis: update on pathophysiology, clinical manifestations, and management. Clinical infectious diseases. 1997 Jun 1;24(6):1035-45.
- 20. Membrilla-Fernández E, Sancho-Insenser JJ, Girvent-Montllor M, Álvarez-Lerma F, Sitges-Serra A, Secondary Peritonitis Spanish Study Group. Effect of initial empiric antibiotic therapy combined with control of the infection focus on the prognosis of patients with secondary peritonitis. Surgical infections. 2014 Dec 1;15(6):806-14.
- 21. Ross JT, Matthay MA, Harris HW. Secondary peritonitis: principles of diagnosis and intervention. Bmj. 2018 Jun 18;361.
- 22. Malangoni MA, Inui T. Peritonitis-the Western experience. World journal of emergency Surgery. 2006 Dec;1(1):1-5.
- 23. Satapathy MC, Dash D, Panda C. Modified Grahams' omentopexy in acute perforation of first part of duodenum; A tertiary level experience in South India. Saudi Surgical Journal. 2013 Sep 1;1(2):33.
- 24. Arora BK, Arora R, Arora A. Modified Graham's repair for peptic ulcer perforation: reassessment study. International Surgery Journal. 2017 Apr 22;4(5):1667-71.
- 25. Judd ES, Phillips JR. Pyloroplasty: Its Place in The Treatment of Peptic Ulcer. Annals of surgery. 1934 Jul;100(1):196.
- 26. Lagoo J, Pappas TN, Perez A. A relic or still relevant: the narrowing role for vagotomy in the treatment of peptic ulcer disease. The American Journal of Surgery. 2014 Jan 1;207(1):120-6.
- Jhobta RS, Attri AK, Kaushik R, Sharma R, Jhobta A. Spectrum of perforation peritonitis in India-review of 504 consecutive cases. World journal of Emergency surgery. 2006 Dec;1(1):1-4.