European Review for Medical and Pharmacological Sciences 2013; 17(Suppl 1): 127-132

Sigmoid colon torsion: mortality and relevant risk factors

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Abstract. – INTRODUCTION: Sigmoid volvulus is an important acute intestinal obstruction, leading to high mortality and requiring urgent operation. The purpose of this study is to analyze risk factors for mortality in patients that were operated on due to sigmoid volvulus at our Department.

MATERIALS AND METHODS: The retrospective study included 158 patients, who were operated on due to sigmoid volvulus between January 1994-December 2010, in terms of age, gender, complaints at admission, physical signs, period of symptoms before admission, associated diseases, laboratory and radiological parameters, hospital stay, morbidity, and mortality.

RESULTS: The study consisted of 135 men (85.4%) and 23 women (14.6%), with a mean age of 62.54 years. Cardiovascular disease and respiratory disease were present in 34 (21.5%) and 42 (26.6%) patients, respectively. Urgent operation was undertaken in 125, while 33 received elective surgery. Abdominal distension and pain was evident in all the patients. Generalized tenderness was detected in 58.2%, while 70.9% had hyperactive bowel sound with tympanism. Plain radiograph revealed an impression of "omega ans" in all patients, while free air was detected in 11.4% of them. Risk factors for mortality included age (p = 0.008), delayed admission (p = 0.001), cardiovascular and respiratory diseases (p = 0.001), fluid-electrolyte imbalance (p =0.001), presence of necrosis (p = 0.001), and major contamination (p = 0.001). Wound infection and intraabdominal abscess were more common in patients that developed mortality (p = 0.001 and p = 0.002).

CONCLUSIONS: Complications like wound infection and intraabdominal abscess are more frequent in the patients with the risk of mortality. Delayed admission results in higher risk of mortality. Mortality rates can be reduced by early admission, preoperative intensive resuscitation, suitable antibiotics, and emergent and viable surgery.

Key Words:
Sigmoid volvulus, Morbidity, Mortality.

Introduction

Sigmoid volvulus (SV) is a major cause of intestinal obstruction, which results from twisting of the sigmoid colon on its own mesentery[1,2]. It was first defined by Von Rokitansky in 1836[3]. In developed countries, SV ranks the third among large intestine obstructions following cancer and diverticular diseases[4]. It represents 4% of all cases in developed countries and 50% in developing countries[5]. Etiological factors vary according to countries; in developed countries chronic constipation is held responsible, while the responsibility in developing countries pertains to high-fiber foods[6]. Reported mortality in patients with non-gangrenous sigmoid colon and gangrenous sigmoid colon are 6-24% and 11-80%, respectively[7,8]. Most deaths are the result of coexisting disease, rather than a direct result of the procedure itself or complications related to the procedure[2,4]. The present study is aimed to find out risk factors for the mortality in SV patients.

Materials and Methods

The retrospective study included 158 patients who were operated on due to SV at Dicle University School of Medicine Department of General Surgery between January 1994-December 2010. Age, gender, complaints at admission, physical signs, period of symptoms before admission, associated diseases, laboratory and radiological parameters, hospital stays, morbidity and mortality rates were recorded. SV was diagnosed through anamneses, physical signs and repetitive plain radiographs. The other features were metallic sound and hyperactive bowel sound, along with complaints like vomiting or fecal and gaseous impaction. The cardinal feature was the "omega" sign of the distended, twisted sigmoid colon. All

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the patients were given nasogastric tube once they were denied oral intake, and urinary catheters were installed for proper urinary follow-up. Laparotomy was performed on all patients after resuscitation of active fluid, correction of any electrolyte and acid base disturbances, and establishment of satisfactory urine output (catheter monitoring). No anesthetic or sedative medication was given during initial treatment. Following regular plain radiographs taken at intervals of 12 or 24 hours, patients that recovered with detorsion were operated on in 4-5 days[1]. Patients with failed detorsion and those detected with necrosis and peritonitis were operated on urgently. Gentamycin 80 mg, ampicillin/sulbactam 1gr and metronidazole 500mg were administered intravenously at the time of induction of anesthesia. Non-gangrenous patients detected with no major contamination received antibiotic medication on the first postoperative day, while the ones with major contamination repeated the medication for 4 times in 7-10 days. At laparotomy, viability of the bowel was assessed through a lower mid line incision. Gaseous distention of the large bowel was relieved either by antegrade decompression or any catheter aspiration. Emergency operative procedures performed between January 1994-December 2010 were as following; (1) appendectomy plus on-table colonic irrigation plus resection and primary anastomosis without protective ileostomy for patients detected with no gangrene or major contamination, (2) Detorsion plus mesosigmoidoplasty or colopexy resection for patients with high risk of operation, and (3) Resection plus end Hartmann's procedure for gangrenous patients. Elective procedures were as following: (1) bowel preparation plus primary resection and colocolic anastomosis, and (2) detorsion plus mesosigmoidoplasty or colopexy for patients with high risk of operation[9]. Emergency operative procedures performed between January 2002-December 2010 were; (1) resection and primary anastomosis without protective ileostomy for nongangrenous patients, and (2) Hartmann's procedure for gangrenous patients. Elective procedures included resection and primary anastomosis. Patients were divided into two groups: uneventful outcome (Group 1) and fatal outcome (Group 2). Analyzed for risk factors included: age, gender, period of symptoms before admission, cardiovascular disease (ischemic heart disease and/or heart failure), respiratory disease (chronic obstructive pulmonary disease and/or asthma), fluid-electrolyte imbalance (hypo/hyperpotassemia hypocalcaemia, hypo/hypernatremia, elevated level of BUN, metabolic acidosis), leukocytosis (>15000/μL), hypotension (symptomatic, or systolic blood pressure <70 mm Hg), presence of necrosis, and presence of major contamination (purulent or fecaloid peritoneal fluid).

Statistical Analysis

Data analysis was performed with SPSS 13.0 (SPSS Inc., Chicago, IL, USA). Quantitative values were presented as mean ± standard deviation. Student-*t* test was used both for group comparisons and parametric data. For independent categories, chi-square test was used. Risk factors for morbidity and mortality were evaluated by logistic regression test. Odd's-ratio(OR) was calculated for each variant. A p value of < 0.05 was considered to be statistically significant.

Results

The patients consisted of 135 (85.4%) men and 23 (14.6%) women, with a median age of 62.54±16.07 (18-95). Cardiovascular and respiratory diseases were present in 34 (21.5%) and 42 (26.6%) patients, respectively. Leukocytosis was evident in 99 (62.7%). At laparotomy, 92 (58.3%) had intestinal necrosis and 38 (24.1%) major contamination. Number of patients for group 1 and group 2 were 119 (75.3%) and 39 (24.7%), respectively. In univariate analysis, there was no statistical difference related to gender between both groups. The mean age was 60.61±14.81 (18-85) in group 1, and 68.44±18.38 (23-95) in group 2 (p = 0.001). Analyzed risk factors for mortality included period of symptoms before admission, presence of cardiovascular and respiratory diseases (p = 0.001), fluid-electrolyte imbalance (p = 0.001), and presence of necrosis (p = 0.001) and major contamination (p = 0.001). Other parameters for both groups are given in Table I. Urgent operation was performed for 91 (76.5%) patients in group 1, and 34 (87.2%) patients in group 2. Of these, 88 (55.7%) received Hartmann's procedure, while 31 underwent resection and anastomosis. Thirty-two (20.3%) of patients that underwent elective operation received resection and primary anastomosis. Other surgical operations are presented in Table II. Almost all patients in both groups had some degree of abdominal distention and pain. Generalized tenderness was evident in 58.2%, while 70.9% had hyperactive bowel sound with tympanism. Metallic and hyperactive bowel sounds detected in group 1

Table I. Univariate analysis of potential predictors for mortality in patients with sigmoid volvulus.

Parameters	Group 1 n (%)	Group 2 n (%)	p
Gender			
Female	18 (15.1%)	5 (12.8%)	NS
Male	101 (84.9%)	34 (87.2%)	
Age (Mean ± SD (Min-Max) (years)	60.61 ± 14.81 (18-85)	68.44 ± 18.38 (23-95)	0.008
PSBA Mean ± SD (Min-Max) (day)	2.22 ± 0.69 (1-4)	5.51 ± 1.47 (2-10)	0.001
Cardiovascular diseases	12 (10.1%)	32 (82.1%)	0.001
Respiratory diseases	17 (14.3%)	25 (64.1%)	0.001
Hypotension	8 (6.7%)	37 (94.9)	0.001
Leukocytosis	66 (55.5)	33 (84.6)	0.001
Fluid-electrolyte imbalance	11 (9.2)	35 (89.7)	0.001
Elevated abdominal pressure	16 (13.4)	31 (79.5)	0.001
Presence of necrosis	55 (46.2)	37 (94.9)	0.001
Major contamination	10 (8.4%)	28 (71.8%)	0.001
Hospital stay (day)	12.67 ± 4.86 (4-37)	6.15 ± 5.09 (1-25)	0.001

PSBA = Period of symptoms before admission, NS = Not significant, SD = Standard Deviation, Min = Minimum, Max = Maximum.

and group 2 were 67.3% and 17.9%, respectively. The rate of fecaloid vomiting was 10.8% in group 1, and 30.8% in group 2. Typical "Omega shaped" image was shown in plain abdominal graph of all patients, and free air was detected in 11.4% of patients. During hospitalization period, the postoperative complications were wound infection in 16 (10.1%), and intraabdominal abscess in 10 (6.3%). These two complications were more common in group 2, the fatal group (Table III). In multivariate analysis, period of symptoms before admission (p = 0.020, OR=14.82, Cl=143.68) was confirmed as an independent risk factor (Table IV).

Discussion

Clinical and epidemiological definition of SV is well established, while its pathogenesis remains controversial. Those who possess a sigmoid colon with a long loop and narrow base of mesenteric attachment would be more prone to volvulus. The sigmoid colon and mesocolon create an obstruction by twisting around the narrow base. As a result of fluid and air accumulation in the proximal colon, a progressive increase is formed in intraluminal pressure, which in turn promotes venous and arterial obstructions in blood supply[10-12]. Multiple factors are likely to predispose these groups to SV: advanced age, high-fiber diet, medications altering intestinal motility, associated neurological disease with altered intestinal motility, presence of previous surgeries, constipation, pregnancy, Diabetes mellitus, and associated neurological diseases such as dementia and schizophrenia[8,13]. SV has been reported to occur in all age groups, from neonates (*e.g.* Hirschsprung's disease) to elderly[14]. Most often this condition is observed in adults, but the age at which it is most common also varies geographically. In developing countries, a man aged between 40 and 60 years is usu-

Table II. Operative procedures.

	Group 1 (n)	Group 2 (n)	Total n (%)
Emergency			
Resection + anastomosis	25	6	31 (19.6)
Hartmann's procedure	63	25	88 (55.7)
Mesosigmoidoplasty	3	3	6 (3.8)
Elective			
Resection + anastomosis	27	5	32 (20.3)
Mesosigmoidoplasty	1	–	1 (0.6)

Table III. Postoperative morbidity in groups.

Parameters	Group 1 n (%)	Group 2 n (%)	p
Wound infection	6 (5.0)	10 (25.6)	0.001
Intraabdominal abscess	3 (2.5)	7 (17.9)	0.002
Pneumonia	6 (5.0)	2 (5.1)	NS
Colostomy leakage	4 (3.4)	3 (7.7)	NS
Enterocutaneous fistula	4 (3.4)	3 (7.7)	NS
Evisceration	3 (2.5)	5 (12.8)	0.023
Intestinal bleeding	3 (2.5)	–	NS

NS= Not significant.

ally reported, whereas in developed countries, the mean age is between 60 and 70 years[2,13]. There is a marked over-all preponderance of male patients with SV, with a reported ratio of 2.5-9/1[15,16]. It was suggested that the more spacious female pelvic area allowed a greater possibility of spontaneous reduction of a beginning volvulus[9]. Another predisposing factor is the mesocolon, which is longer in men but wider in women[17]. In our series, 85.4% were men, and the male to female ratio was 5.9/1. Age and gender did not prove as independent risk factors for mortality, yet age was found significant for the fatal group.

Common symptoms for acute SV include abdominal pain, nausea-vomiting, and abdominal distension caused by fecal and gaseous impaction. Abdominal distension and elevated bowel sounds that are detected during physical examinations are relevant signs for intestinal hyperactivity, while gangrene or perforation is characterized by: (1) low or no bowel sound, (2) hypotension or tachycardia, (3) presence of rectal melanotic stool in rectal digital examination, and (4) rebound detection in physical examination[9,18-20]. Abdominal pain and distension were present in all our patients. Hypotension and hypoactive bowel sounds were more frequent in the fatal group, whereas hyperactive sounds were detected in the other group. This was mainly associated with the high incidence of gangrene in the fatal group.

Increased morbidity and mortality are promoted by post-24-hours delayed admission and delayed diagnosis[2,19,21-23]. The higher incidence rate of delayed admission in developing countries is best explained by the challenges in health-related transportations and lack of medical awareness[18,19]. Similarly, we consider that the delayed admissions that took place in the early years of our study, which covers a total period of seventeen years, were due to challenging transportation and socioeconomic affairs, while the latter years were characterized by unawareness in crucial issues such as delayed diagnosis, wrong diagnosis, early diagnosis and medical treatment.

Most deaths in SV patients are the result of cardiovascular or respiratory diseases, rather than a direct result of the procedure itself or complications related to the procedure[2,4,21,24]. In the study on gangrenous SV patients by Bhatnagar et al[20], reported risk factors for mortality are age over 60 years, presence of shock at admission, and recurrent volvulus. In our study, cardiovascular and respiratory diseases had a high incidence rate in the fatal group, which was consistent with the literature.

Table IV. Multivariate analysis of predicting factors for mortality in sigmoid volvulus.

Factors	p	Odd's ratio	CI 95%
Age (years)	0.440	1.04	0.941-1.15
Delayed admission	0.020	14.82	1.53-143.68
Cardiovascular diseases	0.66	0.006	0.00-1.43
Respiratory diseases	0.494	6.79	0.028-1641.57
Elevated abdominal pressure	0.080	0.000	0.000-2.48
Fluid-electrolyte imbalance	0.146	0.021	0.000-3.85
Major contamination	0.309	0.08	0.001-10.48

Increased mortality and morbidity arise from peritonitis and endotoxemia, which are caused by various reasons including delayed diagnosis and treatment, intestinal obstruction, intestinal ischemia, necrosis, and hypovolemic shock[2,25]. In our study, necrosis and fluid-electrolyte imbalance in the fatal group were confirmed as 94.9% and 89.7%, respectively, while contamination was evident in 71.8% of patients. The increased intraabdominal pressure elevates the diaphragms, increasing intra-thoracic pressure and, thereby, compressing the lungs. Other effects of increased intraabdominal pressure involve a decrease in perfusion of abdominal viscera[26]. The mortality rate in the fatal group was statistically higher than the one in the uneventful group, which verified the relevant literature.

Hypotension and presence of purulent or fecaloid peritoneal fluid or evidence of macroscopic bowel perforation are reported as predictive factors for postoperative mortality in the patients with gangrenous SV[27]. In our study, we determined that, in addition to presence of necrosis and major contamination, the presence of hypotension was also confirmed as a significant factor predictive for the mortality.

The initial management in SV should be by eliminating obstruction and preventing the risk of recurrence. Spontaneous detorsion is hard to implement. The first step in treatment should include the implementation of detorsion with sigmoidoscopy following the correction of fluid-electrolyte imbalance. Urgent operation should be undertaken for the patients with unsuccessful detorsion and for those detected with peritonitis and necrosis[2,28]. When gangrene is detected in the intestines at laparotomy, resection is mandatory. Postresection sustainability is achieved by anastomosis and colostomy[6,8]. Primary anastomosis is reported to promote morbidity and mortality in gangrenous patients[29]. Thus, Hartmann's procedure (resection plus end colostomy) remains more viable for this patient group[30]. However, for the cases expected to maintain good general condition along with relieved anastomosis, resection plus primary anastomosis is recommended[8,31]. In our study, after resuscitation of active fluid and correction of any electrolyte and acid base disturbances, patients who recovered with detorsion were operated on electively by applying resection and primary anastomosis. The nongangrenous patients in the group with unsuccessful detorsion and the patients with good general condition underwent resection plus primary anastomosis, while the rest received Hartmann's procedure. We considered that postoperative morbidity and mortality were not increased by the application of resection plus primary anastomosis in nongangrenous patients that maintained good general condition, and that the colostomy-induced psychosocial effects and the necessity for a surgical operation was eliminated through this application.

It is reported that associated diseases tend to prolong hospital stays[21]. However, the rate of these diseases did not present statistical significance for hospital stays since it was higher in the fatal group.

Reported morbidity rates for SV patients are between 4-55%. Common complications include wound infection, intraabdominal abscess, evisceration, colostomy leakage, and stomal complications[20,32-34]. Of these, wound infection and intraabdominal abscess had the highest rate of frequency in our study. Arising from numerous conditions including necrosis, contamination, and fluid-electrolyte imbalance, these two complications were more common in the fatal group.

In another study[9] by our Department, reported risk factors included hospital stay, cardiovascular diseases, and age, while delayed admission was the only factor associated with mortality in our study. This change could be adhered to medical and technological advances in the realms of associated diseases, and advanced age.

Conclusions

SV is an important acute intestinal obstruction that leads to high mortality and requires urgent operation. It is more common in males, and in patients over 60 years of age. Wound infection and intraabdominal abscess have a higher incidence rate in the patients with mortality risk. Longer periods of symptoms before admission increase the mortality risk. The risk could be reduced by early admission, preoperative intensive resuscitation, suitable antibiotics, and emergent and viable surgery.

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