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A new classification for ileosigmoid knotting

Aim: This study aimed to establish a new classification that will contribute to the treatment and prognosis of ileosigmoid knotting (ISK), which is a combination of ileum volvulus and sigmoid volvulus (SV).

Materials and methods: Based on the SV classification in which criteria associated with mortality, such as age over 60 years and the presence of accompanying disease and/or shock, were used, and a new classification was made for ISK. For this classification, the records of 71 patients with ISK, who were treated surgically, were reviewed retrospectively, and unlike in SV classification, rather than the presence of sigmoid gangrene alone, the presence of both ileum and sigmoid gangrenes was used in the new classification.

Results: In this series, 15 (21.1%) of 71 patients with ISK died. In this study, mortality was significantly correlated with ileum and/or sigmoid gangrene ($P < 0.05$). A new classification based on SV classification in which criteria associated with mortality, such as age over 60 years and the presence of accompanying disease and/or shock, were used, was made for ISK.

Conclusions: Based on the evaluation of 71 patients with ISK according to the new classification, our clinical experience, and relevant literature, treatment options were suggested for each class, and potential mortality rates were determined. We believe that this new classification will be useful in determination of the treatment and prognosis of ISK.

Key words: Ileosigmoid knotting, sigmoid volvulus, classification, treatment, prognosis

İleosigmoid düğümlenme için yeni bir sınıflama

Giriş ve Amaç: Bu çalışma, ileum volvulusu ve sigmoid volvulusun (SV) bir kombinasyonu olan ileosigmoid düğümlenmenin (ISK) tedavisi ve prognozuna katkıda bulunacak yeni bir sınıflama elde etmek için amaçlandı.

Yöntem ve Gereç: 60 yaşın üzerinde olma, eş hastalık varlığı ve şok varlığı gibi mortalite ile ilişkili kriterler kullanılarak daha önce yapılmış olan SV sınıflaması baz alınarak ISK için yeni bir sınıflama yapıldı. Bu sınıflama için cerrahi olarak tedavi edilen 71 ISK'lı hastanın kayıtları retrospektif olarak incelendi ve SV sınıflamasından farklı olarak yalnız sigmoid gangreni varlığı yerine hem ileum, hem de sigmoid gangreni varlığı kullanıldı.

Bulgular: Bu seride ISK'lı 71 hastanın 15'i (% 21.1) öldü. Bu çalışmada ileumda ve/veya sigmoidde gangren varlığı ile mortalite arasında anlamlı bir ilişki bulundu ($P < 0.05$). Sigmoid volvulus sınıflamasında kullanılan 60 yaşın üzerinde olma, eş hastalık ve şok varlığına ek olarak ileum ve/veya sigmoid kolonda gangren varlığı da kullanılarak ISK için yeni bir sınıflama yapıldı.

Sonuç: Yeni sınıflamaya göre ISK'lı 71 hastanın değerlendirilmesi, klinik deneyimimiz ve konu ile ilgili literatür verilerine dayanarak, her bir sınıf için tedavi seçenekleri önerildi ve beklenen mortalite oranları belirlendi. Bu yeni sınıflamanın, ISK'nın tedavisi ve prognozunu belirlemede yararlı olabileceğine inanmaktayız.

Anahtar sözcükler: İleosigmoid düğümlenme, sigmoid volvulus, sınıflama, tedavi, prognoz

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Introduction

Ileosigmoid knotting (ISK), the wrapping of ileum or sigmoid colon around the mesentery of the other one, is a combination of ileum volvulus and sigmoid volvulus, and is an uncommon cause of intestinal obstruction (1,2). Although the disease was described long time ago, its prognosis is still grave, and there have been controversies as to its treatment, like sigmoid volvulus (SV) (1-5).

The pathophysiology of ISK was described by Shepherd (3) in 1967. The only classification of the disease was made by Alver et al. (4) in 1993 by taking the ileum or sigmoid colon as the active component and considering the direction of the torsion.

In the light of the 42-year experience of our clinic in the management of ISK, the present study aimed to propose a new classification to contribute to the treatment and determination of the prognosis of ISK.

Materials and methods

In this study, a new classification was developed based on the classification made by Atamanalp et al. (5) in 2008 for SV, a component of ISK, using mortality associated criteria, such as age over 60 years, and the presence of accompanying disease or shock. Additionally, the clinical records of 71 patients with ISK, who were treated surgically in the Department of General Surgery, School of Medicine, Atatürk University in a 42-year period between June 1966 and July 2008, were reviewed retrospectively. The diagnosis of ISK was based on clinical, radiological, and operative findings. The presence of ileum and/or sigmoid gangrene was compared to determine any correlation with mortality. Chi-square test was used in statistical analyses. In ISK classification, unlike in SV classification, rather than the presence of sigmoid colon gangrene alone, the presence of both ileum and sigmoid gangrenes was used. Then, 71 patients were reevaluated using the new classification.

Results

Of the 71 patients with ileosigmoid knotting (ISK), 15 (21.1%) died. Mortality was correlated with ileum and/or sigmoid gangrene ($P < 0.05$). In SV classification performed by Atamanalp et al. (5), age over 60 years ($P < 0.001$), existences of an associated disease (chronic obstructive pulmonary disease, cardiac failure, coronary disease, and diabetes mellitus) ($P < 0.01$), and the presence of shock ($P < 0.001$) were also significantly correlated with mortality. However, no correlation was determined between the mortality rate and the criteria used in the ISK classification of Alver et al. (4) ($P > 0.05$). The statistical analyses are presented in Table 1.

The criteria that were significantly correlated with mortality in the previous SV classification and the presence of bowel gangrene in ISK were considered risk factors. Thus, a new classification was developed using these criteria, such as the classification of sigmoid volvulus established by Atamanalp et al. (5) (Table 2). In this proposed classification, the patients were classified as follows: Class 1, patients with no risk factor; Class 2, those with no shock or gangrene but with other risk factors, such as age over 60 years, or

Table 1. The results of statistical analyses.

Criterion	Patient	Death	Statistical analysis
No bowel gangrene	13	0 (0.0%)	$P < 0.5$
Presence of bowel gangrene	58	15 (25.9%)	Significant
Type 1A	34	8 (23.5%)	$P > 0.05$
Type 1B	5	1 (20.0%)	Non-significant
Type 2A	11	2 (18.2%)	
Type 2B	5	1 (20.0%)	
Type 3	1	0 (0.0%)	
Unknown	15	3 (20.0%)	

Table 2. New classification for ISK.

C1	C2		C3		C4		C5	C6
	C2a	C2b	C3a	C3b	C4a	C4b		
A0 D0	One of A,D 1	Two of A,D 1	At most 1 of A,D 1	Two of A,D 1	At most 1 of A,D 1	Two of A,D 1		
S0	S0	S0	S1	S1	S0	S0	S1	
G0	G0	G0	G0	G0	G1	G1	G1	G2

C (Class)
A (Age): A0: under 60 years, A1: 60 years and older
D (Associated disease): D0: absent, D1: present
S (Shock): S0: absent, S1: present
G (Bowel gangrene): G0: absent, G1: present in ileum or sigmoid colon, G2: in both segments

existence of an associated disease; Class 3, those with shock; Class 4, those with single segment bowel gangrene (ileum or sigmoid colon); Class 5, shock and single segment bowel gangrene; and, Class 6, those with gangrene in both segments. Depending on the presence of other risk factors, Class 2, 3, and 4 were further divided into subgroups of a and b. The distribution of 71 patients based on this new classification and their mortality rates are presented in Table 3.

Discussion

Ileosigmoid knotting (ISK) is the wrapping of ileum or sigmoid colon around the mesentery of the other one (1,2). Although its incidence in the world is not well known, it is high in Turkey, particularly in Eastern Anatolia (1,2,4).

The pathophysiology of ISK has been described by Shepherd (3) in 1967. In the light of this definition, in general, the loops of ileum wrap around the sigmoid colon and form a knot. Both the ileal loops and the sigmoid colon become distended. As the knot tightens, a double loop obstruction occurs which may progress to extensive gangrene (4,6). The presence of an elongated ileum and sigmoid colon, and the presence of a narrow base with an elongated mesentery have been held responsible for the anatomicopathology of the disease (1-4,6,7).

ISK was classified only once by Alver et al. (4) in 1993. According to this classification, there are 4 types of ISK. Type I is the most common one and occurs when the ileum (active component) revolves around the sigmoid colon. In Type II, the sigmoid colon (active component) revolves around the ileum. In

Table 3. The distribution and mortality rates of 71 patients according to the new classification for ISK.

	C1	C2		C3		C4		C5	C6
		C2a	C2b	C3a	C3b	C4a	C4b		
Patient	5	4		4		8		6	44
		2	2	2	2	4	4		
Mortality	0 (0.0%)	0 (0.0%)		0 (0.0%)		1 (12.5%)		1 (16.7%)	13 (29.5%)
		0	0	0	0	0	1		

Type III, the ileocecal portion revolves around the sigmoid colon. When it is difficult to determine the active or passive component, it remains undetermined or indefinite type (Type IV). Type I and II can be classified into subtypes of A & B depending on whether the torsion is clockwise or counterclockwise, respectively (1,2,4,6). This classification is clearly based on pathophysiologic and anatomicopathologic findings (4). However, as can be seen in Table 1, the criteria they used are associated with mortality.

The surgical treatment of ISK remains controversial. Some of the controversies are whether a definitive procedure is needed in nongangrenous cases; whether primary anastomosis or stoma is more appropriate for gangrenous cases; the management of cases with perforations and peritonitis as well as the management of the cases with intestinal ischemia, edema, and different proximal and distal intestinal diameter (1,2,4,6-10). On the other hand, although the factors that affect the prognosis negatively have been determined and, after the 1990s, the rate of mortality associated with the disease decreased, the mortality rates have been reported to vary between 0% and 100% for different series, and there are difficulties in predetermining the prognosis (1,2,4,6-10). The previous classification has not discussed the relationship between the types and treatment options and prognosis (4,7). Similarly, using the previous classification, we were not able to detect a significant correlation between mortality and prognosis in our series. Thus, this classification is not helpful in determination of treatment modality and prognosis.

Ileosigmoid knotting is a combination of ileum volvulus and sigmoid volvulus in clinical presentation (1,2). Therefore, we used the criteria used by Atamanalp et al. (5) for SV classification that are associated with mortality, such as age over 60 years, the presence of an associated disease (chronic obstructive pulmonary disease, cardiac failure, coronary disease, diabetes mellitus, etc), the presence of shock (toxic or septic) and then developed an ISK classification. In addition, because ISK is a double segment obstruction, we also used the presence of gangrene in the ileum and/or sigmoid, which we found to be associated with mortality.

In this new classification, advanced age, and associated disease were not evaluated for Class 5, and similarly, the presence of shock was not evaluated for Class 6, which may be considered a limitation. Nevertheless, inclusion of all of these factors in classification will yield more subgroups, thus rendering the classification more difficult and unpractical. It might be more convenient to evaluate these factors based on the individual characteristics of the patients that fall in between groups.

Table 4 presents the findings obtained after the classification and evaluation of 71 patients with ISK according to the new classification proposed, the treatment options recommended for each class in the light of our 42-year clinical experience, and literature review (1,2,4,6-8), and the estimated mortality rates. In patients who do not have gangrene in ileum, generally no additional procedure is needed. In those with gangrene, primary anastomosis is preferred following ileum resection (1-3,6,7). Yet, in patients with shock and gangrene in both segments; with perforation and fecal peritonitis; with ischemia in the intestines; and in those with edema and difference in the diameter of the ileum segments, ileostomy might be performed despite its high morbidity (1). In our opinion, in such cases, primary anastomosis followed by second look laparotomy might prove a better alternative to stoma. On the other hand, the treatment of patients with non-gangrenous sigmoid colon remains controversial (1,2,7). While detorsion alone may be performed on patients with little or no risk, in order to prevent or to reduce the recurrence of sigmoid volvulus, sigmoidomesopexy, sigmoidomesoplasty, or sigmoid resection with primary anastomosis may be alternative to detorsion. Similarly, in those with high risk, detorsion may be the only choice (1,2). In patients with gangrenous sigmoid colon, primary anastomosis should follow sigmoid resection. However, in patients with gangrene in both segments, shock, perforation, and fecal peritonitis and in those with ischemic intestines, edema and difference in sigmoid diameter, colostomy may be life saving despite its high morbidity (1).

ISK carries a grave prognosis with mortality rate ranging between 0% to 100% (1-4,6-8). The average mortality rate has declined from 0% to 73.6% before 1990 to 0% to 47% after 1990 (6). Estimated mortality rates for different classes of patients based on the

Table 4. Suggested surgical treatment methods and estimated mortality rates.

Class			Treatment	Mortality
C1		Sigmoid colon	Detorsion, or sigmoidomesopexy, or sigmoidomesoplasty (Resection with primary anastomosis)	0-1%
C2	C2a	Sigmoid colon	Detorsion, or sigmoidomesopexy, or sigmoidomesoplasty	1-5%
	C2b	Sigmoid colon	Detorsion (Sigmoidomesopexy, or sigmoidomesoplasty)	
C3	C3a	Sigmoid colon	Detorsion	5-20%
	C3b	Sigmoid colon	Detorsion	
C4	C4a	Ileum	Resection with primary anastomosis*	10-30%
		Sigmoid colon	Resection with primary anastomosis**	
	C4b	Ileum	Resection with primary anastomosis*	
		Sigmoid colon	Resection with primary anastomosis** (Resection with stoma)	
C5		Ileum	Resection with primary anastomosis*	15-50%
		Sigmoid colon	Resection with stoma (Resection with primary anastomosis**)	
C6		Ileum	Resection with primary anastomosis* (Resection with stoma)	20-80%
		Sigmoid colon	Resection with stoma	

* In the presence of bowel ischemia, edema, perforation, and difference in ileum diameter: resection with stoma, or resection with primary anastomosis and second look laparotomy

** In the presence of bowel ischemia, edema, perforation, and difference in sigmoid diameter: resection with stoma

( )Second choice

findings obtained in the evaluation of our series of ISK patients, our experience spanning 42 years, and literature findings (1-4,6-8) might be helpful in determination of ISK prognosis.

In conclusion, ISK is a rare disease with poor prognosis and its treatment remains controversial. The disease is not easy to classify because most publications on ISK are either case reports or present series with low numbers of patients, and all of them are retrospective studies. We believe that the new classification method for ISK proposed in this study might be useful in the management of treatment and estimation of prognosis. However, prospective studies with larger series based on this classification method will be helpful in substantiation of the new method suggested here.

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