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Is language disability a risk factor for complicated appendicitis? A retrospective cohort study

Dil engeli, komplike apandisit için bir risk faktörü müdür? Geriye dönük kohort çalışma

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Abstract

Aim: Acute appendicitis is the most common emergent surgical disease and complicated appendicitis is an indicator of disrupted access to healthcare. Language disability has become more important in the healthcare sector with increasing migration in the last decade. We aimed to evaluate language disability as a risk factor for complicated appendicitis.

Methods: From January 2014 to December 2018, patients who were operated for acute appendicitis were evaluated retrospectively. Patients' age, gender, language disability (LD) (no (C) or yes (F)), whether surgical drainage was required, pathological findings (appendix diameter, severity as uncomplicated (UCA) or complicated (CA), and presence of local peritonitis), levels of C-Reactive Protein (CRP), White Blood Cells (Wbc), Neutrophil% (Neu%), and ultrasonography (USG) and computed tomography (CT) results were noted and compared.

Results: Six hundered twenty-eight patients were included in the study, among which 15.1% (n=95) were considered F, and 12% (n=74) were CA. Age and gender did not significantly differ in terms of LD and severity (P=0.15, P=0.24 and P=0.2, P=0.21, respectively). Drainage requirement, local peritonitis, levels of CRP, Wbc, and Neu% were significantly higher in the CA group (P<0.001, P<0.001, P<0.001, P=0.009, and P<0.001, respectively). Drainage, appendix diameter, levels of CRP, and Neu% were significantly higher in the F group (P=0.01, P=0.04, P=0.007, and P=0.046, respectively). CA rate was insignificantly higher in the F group (17% vs 11%) (P=0.72). The false-negative ratio of USG and CT was higher in F patients with CA (56.2% vs. 37.5%).

Conclusion: This study showed that language disability could be a risk factor for complicated appendicitis with higher drainage ratio, appendix diameter, levels of CRP, and Neu%.

Keywords: Appendicitis, Severity, Language disability

Öz

Amaç: Akut apandisit en sık acil cerrahi hastalık ve komplike apandisit sağlık kuruluşlarına erişebilme göstergesidir. Son on yılda göçlerin artması ile dil engeli sağlık için önemli hale gelmiştir. Dil engelinin komplike apandisit için risk faktörü olarak değerlendirmeyi amaçladık.

Yöntemler: Ocak 2014'den Aralık 2018 tarihleri arasında akut apandisit nedeni ile opere edilen hastalar geriye dönük değerlendirildi. Hastaların yaş, cinsiyet, dil engeli (DE) (var (Y) yok (V)), drenaj uygulanması, patolojisi (apandiks çapı, şiddeti komplike olan (KA), komplike olmayan (KOA), ve lokal peritonit varlığı), C-Reaktif Proteini (CRP), beyaz küre (BK), nötrofil yüzdesi (Nöt%), ultrasonografi (US) ve bilgisayarlı tomografi (BT) sonuçları istatistiksel olarak değerlendirildi.

Bulgular: Altı yüz yirmi sekiz hasta çalışmaya dahil edildi. %15,1'i (n=95) Y, ve %12'si (n=74) KA idi. DE ve şiddet açısından yaş ve cinsiyet farkı istatistiksel olarak anlamlı saptanmadı (sırasıyla P=0,15, P=0,24 ve P=0,2, P=0,21). Drenaj, lokal peritonit, CRP, BK ve Nöt% KA grubunda anlamlı olarak yüksek saptandı (sırasıyla P<0,001, P<0,001, P<0,001, P=0,009, ve P<0,001). Drenaj, apandiks çapı, CRP ve Nöt% seviyesi Y gurunda anlamlı olarak yüksek saptandı (sırasıyla P=0,01, P=0,04, P=0,007 ve P=0,046). KA oranı Y grubunda daha fazla olmasına rağmen (%17 karşı %11) istatistiksel olarak anlamlı (P=0,72). US ve BT'nin yalancı negatiflik oranı KA'lı Y grubunda daha yüksek saptandı (%56,2 karşı %37,5).

Sonuç: Bu çalışma dil engelinin; yüksek drenaj oranı, apandiks çapı, CRP ve Nöt% seviyeleri ile komplike apandisit için bir risk faktörü olabileceğini göstermiştir.

Anahtar kelimeler: Apandisit, Şiddet, Dil engeli

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Introduction

Ten percent of Europe and 4.8% of Turkey are foreigners (immigrants, tourists, etc.) with language disability [1,2]. The language disability, difficulty in accessing healthcare, or lack of health insurance are the most important disadvantages of foreign healthcare [3,4]. Language disability decreased with the second generation of immigrants due to their learning of the primary language. Lack of access to healthcare or health insurance are not valid factors for all foreigners admitted to the emergency department Turkey. However, language disability remains a severe problem and causes complications.

Acute abdominal pain is an important, frequent complaint which was observed in 10% of the emergency department admissions and only 1.9% were caused by acute appendicitis [5,6]. Acute abdominal pain has a 10.5% false-positive and 18,6% false-negative decision risk. False-positive decisions cause unnecessary appendectomies with increased morbidity and mortality, and false-negative decisions increase perforation or abscess risk [7]. Complicated acute appendicitis is considered an indicator of lack of access to healthcare in children based on communication disabilities [8]. Foreigners have increased risk of perforated/complicated appendicitis or unnecessary surgery for acute abdominal pain [9,10].

Radiological (USG and CT), scoring systems (Alvarado, etc.), or inflammatory markers such as C-Reactive Protein (CRP), White Blood Cells (Wbc), and Neutrophil % (Neu%) are used to evaluate the severity of acute appendicitis [11-14].

Ten percent of admissions for emergency surgery consisted of foreigners with or without language disability, and appendicitis is the most common emergency surgical disease in our hospital. We aimed to evaluate language disability as a risk factor for complicated appendicitis.

Materials and methods

After receiving institutional approval from the ethics committee of Okmeydanı Training and Research Hospital (14 May 2019 date, and 1148 number), records of patients who were operated for acute appendicitis between January 2014 and December 2018 were evaluated retrospectively. The foreigner patients who can speak Turkish, English or other common languages were excluded from the group of patients with language disability (Figure 1).

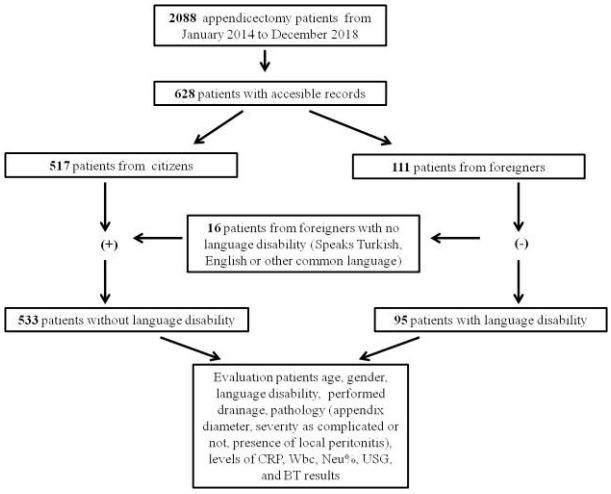

Figure 1: Flow diagram of the study. (CRP: C-reactive protein, Wbc: White Blood Cell, Neu%: Neutrophil %, USG: Ultrasonography, CT: Computed Tomography)

Age, gender, language disability, operation type, whether surgical drainage was performed, pathological findings (diameter of the appendix, severity, the presence of local peritonitis, and fecaloid), levels of C-reactive protein (CRP), white blood cells (Wbc), neutrophil % (Neu%), results of ultrasonography (USG) and computed tomography (CT) were evaluated retrospectively.

Language disability was evaluated as without (C) or with (F), and gender, as male or female. Operation methods were either open or laparoscopic, and whether surgical drainage was performed was noted. The severity of pathology was evaluated as uncomplicated (UCA) (appendicitis, phlegmonous, and suppurative) or complicated appendicitis (CA) (gangrenous and perforated). Local peritonitis and fecaloids were evaluated as yes or no. USG and CT were either (0) not performed, (1) performed but negative, or (2) performed and positive for acute appendicitis.

Severity of appendicitis and language disability were assessed with respect to age, gender, need for surgical drainage, appendix diameter, presence of local peritonitis, levels of CRP, Wbc, and Neu%. USG and CT results of patients with and without language disability were compared with regards to severity of appendicitis.

Statistical analysis

Statical analysis was performed with SPSS 15.0. T-test was used to evaluate age, diameter, CRP (mg/dl), Wbc (10^3/uL), Neu% (%) (Mean (Standard derivation)). The ratio of males to females, language disability, drainage requirement, local peritonitis, USG, and CT were calculated in percentages. Chi-Square, Mann Whitney U, and T-Test were used for assessment, and $P<0.05$ was considered statistically significant. ROC analysis was performed for language disability, CRP, WBC, Neu% according to CA. Cut off values, sensitivity, and specificity of CRP, Wbc and Neu% were noted.

Results

Six hundred twenty-eight patients were included in the study, 15.1% (n=95) of which had language disability (foreigners (F) not citizens (C)). The mean age was 30.31 (12.6) years, and 67% (n=421) of the patients were males. Among all, 55.7% (n=350) of the operations were performed laparoscopically, 13% (n=81) had surgical drainage. The mean appendix diameter was 10.54 (5.4) mm. Twelve percent (n=74) of the patients had CA, 63% (n=397) had local peritonitis, and 62.9% (n=395) had fecaloids. The mean CRP, WBC, and Neu% values were 54.5 (79.4) mg/dL, 14.6 (4.6) 10^6/uL, and 77.4% (10.3), respectively (Table 1).

The mean age was 29.86 (12.28) years among the UCA group, and 33.66 (14.86) years among those with CA. 66.2% of the UCA and 73% of the CA patients were male. 8.3% (n=46) of patients with UCA and 47.3% (n=35) of CA patients required surgical drainage, the difference between which was statistically significant ($P<0.001$). The mean diameter of the appendix was 10.39 (5.56) mm in UCA, and 11.68 (3.69) mm in CA groups ($P=0.055$). The language disability rates were 14.3% (n=79) and 21.6% (n=16) among those with UCA and CA, respectively, which were similar ($P=0.97$). 59% (n=327) of the UCA and

94.6% (n=70) of the CA patients had local peritonitis, which was significantly higher in the CA group (*P*<0.001) (Table 2).

Table 1: Age, gender, language disability, operation type, drainage, diameter, severity of appendicitis, local peritonitis, fecaloids, CRP, Wbc and Neu% values of included patients

Age (years)*	30.31 (12.6)	
Gender	n	%
Male	421	67
Female	207	33
Language Disability	n	%
No (C)	533	84.9
Yes (F)	95	15.1
Operation type	n	%
Open	278	44.3
Laparoscopic	350	55.7
Drainage	n	%
No	547	87
Yes	81	13
Diameter (mm)*	10.54 (5.4)	
Severity of Appendicitis	n	%
Uncomplicated	554	88
Complicated	74	12
Local Peritonitis	n	%
No	231	37
Yes	397	63
Fecaloid	n	%
No	233	37.1
Yes	395	62.9
CRP (mg/dl)*	54.5 (79.4)	
Wbc (103/uL)*	14.6 (4.6)	
Neu%*	77.4 (10.3)	

* Mean (Standard Derivation), C: Citizens, F: Foreigners. CR*P*= C-reactive protein, Wbc: White Blood Cell, Neu%: Neutrophil %

Table 2: Comparison of the severity of appendicitis with regards to age, gender, drainage, appendix diameter, language disability, local peritonitis, CRP, Wbc and Neu%

	Severity of Appendicitis				*P*-value
	Uncomplicated (n=554)		Complicated (n=74)		
Age (years)*	29.86 (12.28)		33.66 (14.86)		0.15
Gender	n	%	n	%	0.24
Male	367	66.2	54	73	
Female	187	33.8	20	27	
Drainage	n	%	n	%	
No	508	91.7	39	52.7	<0.001
Yes	46	8.3	35	47.3	
Diameter (mm)*	10.39 (5.56)		11.68 (3.69)		0.55
Language Disability	N	%	n	%	0.97
No	475	85.7	58	78.4	
Yes	79	14.3	16	21.6	
Local Peritonitis	n	%	n	%	<0.001
C	227	41	4	5.4	
F	327	59	70	94.6	
CRP (mg/dl)*	44.97 (71.77)		124.61 (97.17)		<0.001
Wbc (103/uL)*	14.47 (4.43)		15.97 (5.59)		0.009
Neu%*	76.83 (10.5)		81.87 (7.36)		<0.001

* Mean (Standard Derivation), C: Citizens, F: Foreigners. CRP: C-reactive protein, Wbc: White Blood Cell, Neu%: Neutrophil %

The mean CRP value of those in the CA group was significantly higher than those in the UCA group (124.61 (97.17) mg/dl vs. 44.97 (71.77)) (*P*=0,001). The same applied for WBC and Neu% values (15.97 (5.59) 10^3/uL vs. 14.47 (4.43) 10^3/uL (*P*=0.009) and 81.87% (7.36) vs. 76.83% (10.5) (*P*=0.001), respectively) (Table 2).

The mean ages of C and F patients were 30.58 (13.16) and 28.77 (9.26) years, respectively. 66% (n=352) of C and 72.6% (n=69) of F patients were male. 11% (n=59) of C and 23.2% (n=22) of F patients required surgical drainage, the difference between which was statistically significant (*P*=0.01). The mean diameter of the appendix was 10.36 (4.29) mm among C, and 11.59 (9.39) mm among F groups (*P*=0.04). 11% (n=58) of the C and 17% (n=16) of F patients had CA (*P*=0.72). 63.4% (n=338) of the C and 62.1% (n=59) of the F patients had local peritonitis (*P*=0.80) (Table 3).

The mean CRP value was 50.76 (77.38) mg/dl among C and 74.64 (87.62) mg/dl among F patients (*P*=0.007). In the C and F groups, the mean WBC values were 14.68 (4.47) 10^3/uL and 14.45 (5.34) 10^3/uL, respectively (*P*=0.654), and mean Neu% values were 77.08 (9.91) % and and 79.34 (12.18) % (*P*=0.046), respectively (Table 3).

Comparison of USG and CT results between UCA and CA groups is presented in Table 4. USG or CT was not performed in 0.8% (n=4) of C, and 1.3% (n=1) of F patients in the UCA group. CT was not performed in 63.3% (n=301) of C, and 64.5% (n=51) of F patients in UCA, and 48.3% (n=28) of those in C, and 50% (n=8) of F patients in CA. The false negative USG rate in UCA was 27.8% (n=131/470) among C, and 26.9% (n=21/78) among F patients. The false negative USG rates among the CA group was 43.1% (n=25/58) in C, and 56.2% (n=9/16) in F patients. The false negative CT among UCA was 9.3% (n=16/173) in C, and 21.4% (n=6/28) in F patients. The false negative CT in CA was 3.3% (n=1/30) in C, and 37.5% (n=3/8) in F patients. Comparisons of USG and CT yielded statistically significant results in both C and F patients with UCA (*P*<0.001, *P*=0.014 respectively), and significant results in F patients with CA (*P*=0.036).

In CA, the Area Under Curve (AUC) value was 0.530 (*P*=0.354) for language disability, and 0.782 (*P*<0.001) for CRP. The cut off value was 44.17 with 77% sensitivity and 72% specificity in CA. The AUC value was 0.567 (*P*=0.063) for WBC, while the cut off value was 14.5 with 55% sensitivity and 54% specificity in CA. The AUC value for Neu% was 0.641 (*P*<0.001), the cut off value being 80.45 with 65% sensitivity and 57% specificity in CA (Table 5) (Figure 2).

Table 3: Comparison age, gender, drainage, diameter, severity of appendicitis, local peritonitis, CRP, Wbc and Neu% with respect to language disability

	Language disability				*P*-value
	C (n=533)		F (n=95)		
Age (years)*	30.58 (13.16)		28.77 (9.26)		0.20
Gender	n	%	n	%	0.21
Male	352	66	69	72.6	
Female	181	34	26	27.4	
Drainage	n	%	n	%	
No	474	89	73	76.8	0.01
Yes	59	11	22	23.2	
Diameter (mm)*	10.36 (4.29)		11.59 (9.39)		0.04
Severity of appendicitis	n	%	n	%	0.72
Uncomplicated	475	89	79	83	
Complicated	58	11	16	17	
Local peritonitis	n	%	n	%	0.80
No	195	36.6	36	37.9	
Yes	338	63.4	59	62.1	
CRP (mg/dl)*	50.76 (77.38)		74.64 (87.62)		0.007
Wbc (103/uL)*	14.68 (4.47)		14.45 (5.34)		0.654
Neu%*	77.08 (9.91)		79.34 (12.18)		0.046

* Mean (Standard Derivation), C: Citizens, F: Foreigners. CRP: C-reactive protein, Wbc: White Blood Cell, Neu%: Neutrophil %

Table 4: Comparison the severity of pathology and language disability between ultrasonography (USG), computed tomography (CT)

Pathology	Language disability	USG	BT			*P*-value
			0	1	2	
UCA	C	0	4	1	0	<0.001
		1	44	6	81	
		2	253	10	76	
	F	0	1	0	0	0.014
		1	8	1	12	
		2	42	5	10	
CA	C	1	9	0	16	0.146
		2	19	1	13	
	F	1	2	3	4	0.036
		2	6	0	1	

C: Citizens, F: Foreigners, USG: Ultrasonography, CT: Computed Tomography, 0: Not Performed, 1: Performed but Negative, 2: Performed and Positive

Table 5: ROC analysis results of language disability, CRP, Wbc, and Neu% according to severity of appendicitis

Parameters	AUC	SE	*P*-value	95% CI		Cut-off value	Sensitivity (%)	Specificity (%)
				Lower	Upper			
Language Disability	0.530	0.033	0.354	0.465	0.595	---	---	---
CRP	0.782	0.029	<0.001	0.726	0.839	44.17	77	72
Wbc	0.567	0.036	0.063	0.496	0.638	14.5	55	54
Neu%	0.641	0.031	<0.001	0.579	0.702	80.45	65	57

ROC: Reciever Operating Caracteristics, CRP: C-reactive protein, Wbc: White blood cell, Neu: Neutrophil. AUC: Area Under Curve, SE: Standard Error, CI: Confidence Interval

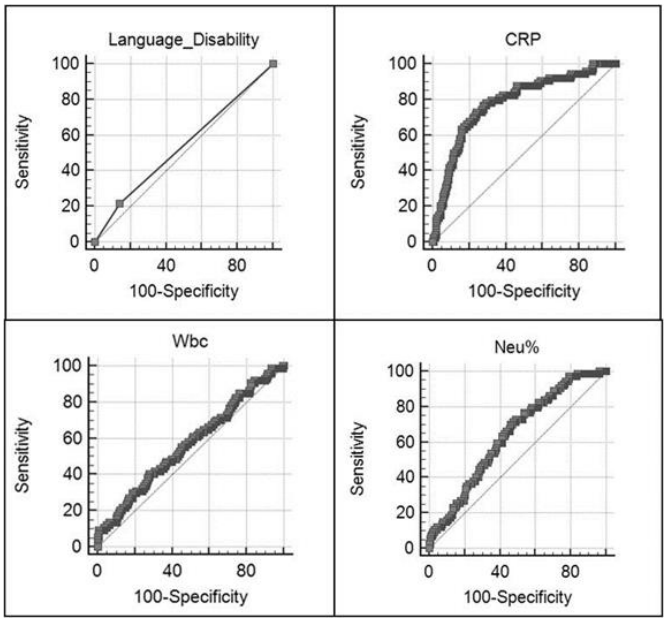

Figure 2: ROC curve of language disability, CRP, Wbc, and Neu% according to severity of appendicitis. (CRP: C-reactive protein, Wbc: White Blood Cell, Neu%: Neutrophil %)

Discussion

Among all, 16.5-24.4% of the appendicitis cases were complicated. CA is reported as an indicator of delayed access to healthcare, and a sign of late diagnosis. Prediction of complicated appendicitis is important for preventing further complications, morbidity, and mortality. Numerous studies are performed for predicting the risk factors of CA with clinical, radiological, biochemical, or mixed parameters. Various scoring systems were also developed for predicting CA [11-16].

The number of patients with language disability has increased with migration. Diagnosis of the disease can be difficult, and misdiagnosis is possible when the patient and doctor have language disabilities, which is a potential risk factor for complicated diseases such as CA [17,18]. The ratio of acute appendicitis in patients with language disability is reportedly 1.5-3.28% [9,10]. In a recent study, the ratio of acute appendictis in patients with language disability was higher than that reported in the literature, with 5.8% (n=111/2088).

Both CA and UCA are mostly seen in males. 53.6% of all appendectomies, 54% of CA, and 53.3% of the F appendectomies were performed males, as reported in the literature [2,9,10,19,20]. Another recent study found that the ratio of males was insignificantly higher than the literature.

Requiring drainage at surgery and finding of local peritonitis at pathological examination are signs of CA, for which increased diameter appendix (>12 mm) is reported as a risk factor [12,21]. A recent study reported higher rates of drainage requirement, local peritonitis, and increased appendix diameter in CA. Increased rate of the above-mentioned findings in F patients showed that language disability was a risk factor for CA.

For CA, the sensitivity and specificity of CRP, WBC, and Neu% were 51.4-78.57% and 60.31-85.7%, 43-67.5% and 36.3-73.8%, 58.5-60.1% and 60.1-90.9%, respectively [22-25]. In another study, the sensitivity and specificity of CRP for CA was 77% and 72%, with a cut-off value of 44.17. Mean CRP levels were significantly higher in CA as well as in F patients. The sensitivity and specificity of WBC were 55% and 54%, respectively, for CA, with a cut-off value of 14.5. Mean WBC levels were significantly higher in CA, but not in F patients. The sensitivity and specificity of Neu% were 65% and 57%, respectively, for CA with a cut-off value of 80.45. Mean Neu% levels were significantly higher in CA and F patients. In a recent study, increased CRP, and Neu% were significant predictors of CA. Also, higher CRP, and Neu% in F patients showed that language disability was a risk factor for CA.

The false diagnosis of appendicitis varies from 12 to 42% in literature. USG is the initial imaging modality for diagnosis of acute appendicitis with 44-90% sensitivity and 47-95% specificity. It has a 15-30% false-negative ratio for acute appendicitis. The sensitivity and specificity of CT is 72-97% and 91-99% respectively; however, the prevalence of positive findings was 23.5% [26,27]. In one of the latest studies, the false-negativity ratios of USG in CA among C and F patients (27.8% vs 26.9%) were similar to that reported in the literature, but the ratio in CA was higher in both C and F (43.1% vs 56.2%). The false-negativity ratios of CT in both CA and UCA were higher in F than C patients (21.4% vs 9.3% in UCA, and 37.5% vs 3.3% in CA). The development of complicated appendicitis for patients with language disability is also affected from false negative radiologic results.

Limitations

The retrospective nature of this study was its first limitation. Prospective randomized clinical trials with large numbers of patients, and translators, will provide further evidence regarding language disability being a risk factor for severe diseases.

Conclusions

Language disability becomes a more important risk factor for complicated diseases among immigrants until they can speak the main language of that country or an international language such as English. It could be a risk factor for complicated appendicitis with significantly higher drainage requirement rates, increased CRP, and Neu%. Higher false negative ratios of USG and CT must keep in the mind when evaluating the patients with language disability for acute appendicitis.

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