

# Evaluation and comparison of tick detachment techniques and technical mistakes made during tick removal

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## ABSTRACT

**BACKGROUND:** Tick is among the important ectoparasites of humans and animals. Ticks may transmit disease-causing pathogens to humans. Tick contact may be resulted in several viral and bacterial infections, including Crimean-Congo Hemorrhagic Fever. Timely removal of ticks with appropriate methods is important in prevention of disease transmission. There are many methods reported for tick detachment. In this study, we aimed to evaluate two of them, suture lassoing and freezing and to compare both methods and to examine technical mistakes with these techniques.

**METHODS:** This study was designed as a prospective cross-sectional study, and included the ticks detached by healthcare professionals or directly by patients who presented to the emergency department due to tick contact. The ticks were recorded as larvae, nymphs, and adults according to their growth period. Ticks detachment types with surgical sutures and removal mistakes were recorded.

**RESULTS:** The majority (77.4%) of the ticks were removed by healthcare professionals and a lower rate by patients themselves with hand (22.6%). No technical mistake was found in 72 (77.4%) patients, and the tick was detached as a whole, while detached broken in 15 (16.1%) patients, and the tick was detached as a whole, but the sutures were attached wrong in six (6.5%) patients. Tick broken off due to technical mistakes was most commonly seen in the ticks removed by the individuals themselves.

**CONCLUSION:** The results of this study suggest that when appropriately and correctly used, both suture lassoing and tweezers are effective in tick removal. Public awareness-raising and training programs should be increased on this issue.

**Keywords:** Suture lassoing technique; tick; tick removal; tweezers technique.

## INTRODUCTION

Tick is among the important ectoparasites of humans and animals. Twenty-eight tick species known to feed on humans play a role as a vector in disease transmission.<sup>[1]</sup> Ticks are important concerning diseases with high mortality, which they mediate the transmission and public health. Crimean-congo hemorrhagic fever (CCHF), which is a tick-borne viral disease and affects a wide geographic area, including Turkey, Iran,

Russia, and many Eurasian countries, has led to increased global awareness and implementation of control programs.<sup>[2]</sup> CCHF disease was seen in our country for the first time in 2002, and Turkey is the most affected country with over 10000 definitive diagnoses and more than 500 deaths. These high figures have caused panic in the country, and 300000 presentations a year have been reached due to tick attachment.<sup>[2,3]</sup> Turkish Ministry of Health has established a strong Fighting Structure against ticks through registry system, guidelines,

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interventional algorithms and educations.

It has been shown that ticks' time of feeding on the host they attached, and detachment of ticks with appropriate technique and timely are crucial in disease transmission.<sup>[4]</sup> The size of the epidemic in Turkey has brought effectiveness and sufficiency of tick detachment methods up for discussion. In the recent public guidelines published by the Turkish Ministry of Health, it was stated that a tick could be removed with a cloth or bag without touching once it is noticed.<sup>[5]</sup>

In the present study, we aimed to investigate and compare tick detachment techniques and detachment mistakes in patients who presented to our University Hospital with the complaint of tick attachment.

## MATERIALS AND METHODS

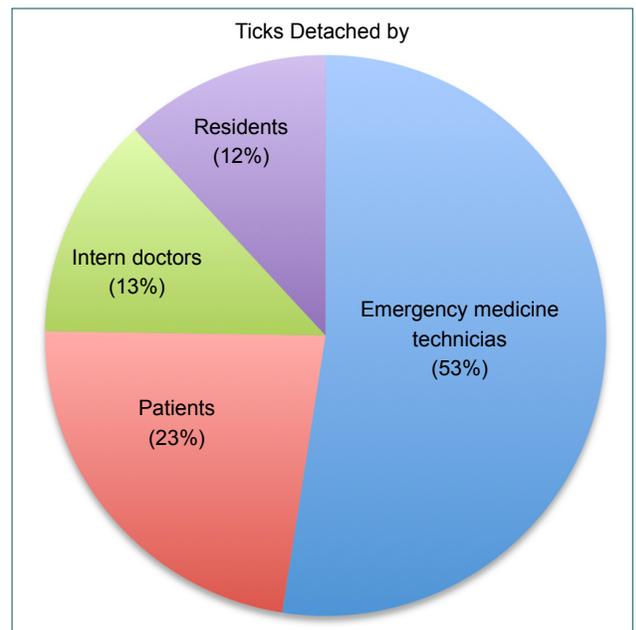
This study was designed as a prospective cross-sectional study and included the patients who presented to the emergency department of Kahramanmaraş Sutcu Imam University with complaints of tick contact between May 2017 and September 2017. Written informed consent forms were received from the participants. Healthcare professionals were not intervened about techniques of tick detachment. The tissue site of tick removal was examined by healthcare professionals and whether any tick piece remained was recorded. The ticks collected were put into 50% ethyl alcohol containing numbered bottles. The ticks were examined by a single microbiologist under the stereotypical microscope, and their species were identified. The ticks were recorded as larvae, nymphs, and adults according to their growth period. The ticks were imaged and determined based on the breakdown or injury of the mouthpart. Ticks detachment types with surgical sutures and removal mistakes were imaged and defined.

### Statistical Analysis

Data obtained from the study were recorded in SPSS 20.0 statistical software. Paired variables were compared using the Chi-square test.  $P < 0.05$  values were considered statistically significant.

## RESULTS

A total of 93 patients who presented to the emergency department with tick contact were included in this study. Of the patients, 68.82% were male and 31.18% were female. The mean age was found as  $41.88 \pm 14.46$  years. The majority of the patients who presented with a history of tick contact were resident in Onikisubat (36.56%) and Dulkadiroglu (24.73%) counties. It was found that majority of the ticks (77.42%) were removed by healthcare professionals, and by the patients themselves by holding with hand and pulling back at a lower rate (22.58%) (Fig. 1). The demographic characteristics of patients who presented to the emergency department with tick contact are given in Table 1.



**Figure 1.** Distribution of the ticks according to the persons who removed them.

Healthcare professionals used sutures (lassoing) in 46 (63.88%) ticks, and tweezers in 26 (36.12%) ticks. Of the sutures used, 54.35% were monofilament and 45.65% polyfilament suture materials. No 5 suture material was the most commonly type

**Table 1.** Demographic characteristics of the patients who presented to the emergency department with tick contact

Demographic feature	n	%
Gender		
Male	64	68.8
female	29	31.2
County of tick contact		
Onikisubat	34	36.6
Dulkadiroglu	23	24.7
Goksun	11	11.8
Andirin	7	7.5
Afsin	6	6.5
Turkoglu	4	4.3
Elbistan	2	2.2
Pazarcik	2	2.2
Nurhak	2	2.2
Caglayancerit	2	2.2
The person who removed the tick		
Emergency medicine technician	49	52.7
Patient herself/himself	21	22.6
Intern doctor	12	12.9
Resident	11	11.8

**Table 2.** Stage and types of the ticks

Tick	n	%
Stage		
Nymph	17	18.3
Adult	76	81.7
Species		
Rhipicephalus sanguineus	41	44.1
Hyalomma spp.	26	27.1
Ixodes spp.	7	7.5
Could not be typed because it was a nymph	7	7.5
Could not be typed because it was broken down	12	12.9

(52.17%) followed by No 4 and No 3 (17.39%–17.36%) as the second most commonly, and No 2 and No 1 (6.52%–6.52%) as the least commonly used materials. Twelve (12.90%) ticks could not be typed since they were entirely broken down. Staging and typing of the ticks were performed after the removal and summarized in Table 2.

The mean removal time of the ticks was found as 32.14±30.69 when detached by the affected persons themselves, 38.54±7.50 when removed with suture materials, and 39.88±39.58 when removed with the tweezer method. When the contact area was checked after detachment of the ticks, mouthparts of the tick was still in the tissue in 15 (16.13%) patients.

When removal of the ticks was examined for technical mistakes, no any technical mistake was found in 72 (77.42%) patients and the tick was detached as a whole, while detached broken in 15 (16.13%) patients, and the tick was detached as a whole, but the sutures were attached wrong in six (6.45%)

patients. All sutures with mistakes were No 1 (n=3, 50%) and No 2 (n=3, 50%), and this caused statistically significant differences when compared to the other suture numbers (p<0.001). Suture mistakes during the detachment are shown in Figure 2.

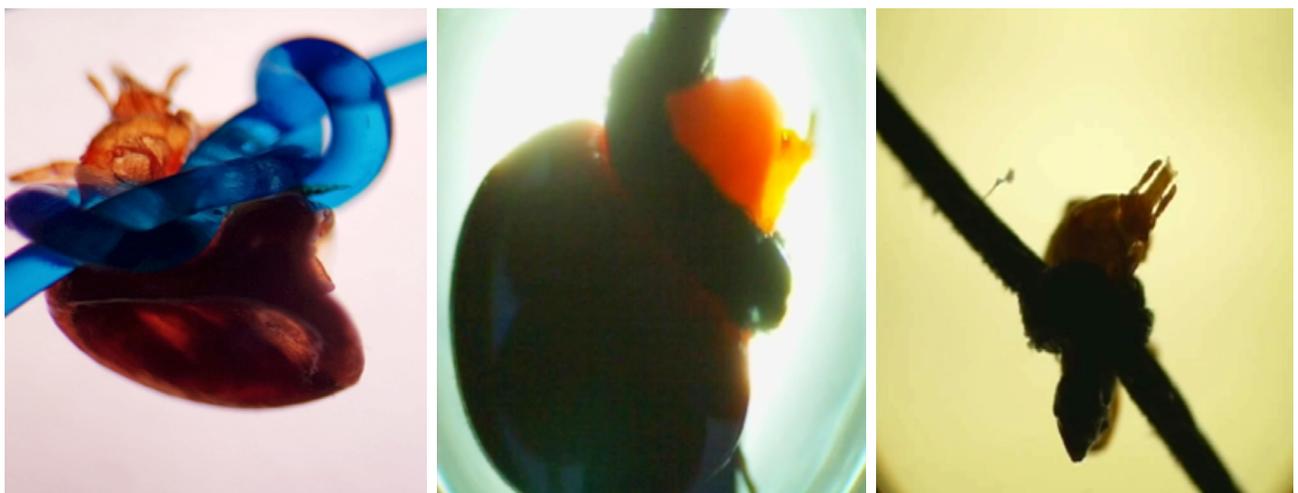
Tick broken off due to technical mistakes was most commonly seen in the ticks removed by the individuals themselves. Comparison of detachment methods and technical mistakes is summarized in Table 3.

When technical mistakes during removal were examined according to the development stages of ticks, mistakes in the break down during removal and wrong suture lassoing were much higher in the ticks at the nymph stage. The comparison of technical mistakes by stages is given in Table 4.

When the participants who removed the ticks and technical mistakes were compared, technical mistakes were much higher when the person who removed the tick was the person with tick contact (Fig. 3).

## DISCUSSION

Tick is a blood-feeding ectoparasite of domestic and wild animals and a vector that transmits disease-causing pathogens to humans worldwide.<sup>[6]</sup> Ticks are considered as the second most common vector for human diseases after mosquitos, but it is the most important vector of disease-causing pathogens in domestic and wild animals. Ticks are thought to be responsible for over 100000 cases all over the world.<sup>[7]</sup> Tick-borne bacterial and viral infections are observed in our country, including Crimean –Congo Hemorrhagic Fever (CCHF), babesiosis, theileriosis, cytauxzoonosis, hepatozoonosis, anaplasmosis, ehrlichiosis, aegyptianelosis, tick-borne typhus, Lyme borreliosis, tularemia, bartonellosis and LSD.<sup>[8]</sup> Tick bites may cause complications, such as impetigo, ecthyma, cellulitis, erysipelas and shallow, painful, purulent ulcers.<sup>[9]</sup>



**Figure 2.** Ticks are detached as a whole, but the suture lassoing is wrong.

**Table 3.** Comparison of the detachment techniques and technical mistakes

Detachment technique	Technical mistake			Total	p
	No mistake whole tick	Tick broken off	Whole tick suturing wrong		
By patients themselves	10	11	0	21	<0.001
Suture lassoing	40	0	6	46	
Tweezers	22	4	0	26	
Total	72	15	6	93	

**Table 4.** Comparison between the development stage of the ticks and technical mistakes

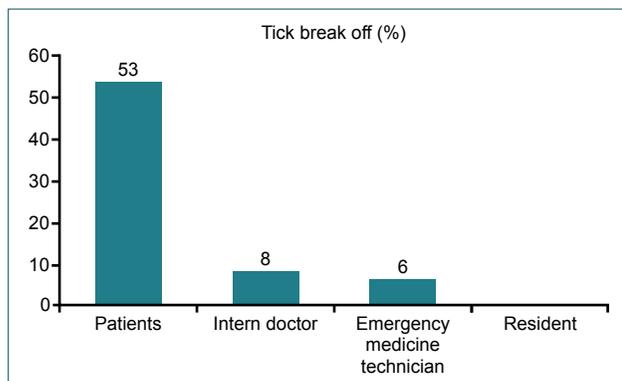
Development stage	Technical mistake			Total	p
	No mistake whole tick	Tick broken off	Whole tick suturing wrong		
Nymph	7	8	2	17	<0.001
Adult	65	7	4	76	
Total	72	15	6	93	

In the cases of tick attachment, timely removal of the attached ticks with appropriate methods is of paramount importance in the prevention of disease transmission.<sup>[10-12]</sup> Ticks should be detached as soon as possible because the risk for disease transmission significantly increases 24 hours after the tick attachment.

In addition to a timely detachment of ticks, it should be completely removed, including mousetrap and the cement secreted by the tick to secure the attachment. The inappropriate detachment of tick may cause mousetrap break off in the skin, leading to infection or granuloma formation. Various techniques have been described for tick removal. Among these, the most studied methods in the literature included card-detachment technique, lassoing technique, freezing method, and tweezers method.<sup>[13]</sup> However, wrong suture thickness selection may cause regurgitation of the tick due to compression to the abdominal region. This is a high

risk, especially in nymphs. In addition, several mechanical, chemical, and physical techniques, such as the use of sharp forceps, crush or squeezing the tick, application of various agents, such as gasoline and lidocaine, burning with match, and manual removal of the tick by twisting; however, scientific evidence to support these methods are limited. It has been shown that chemical applications may cause saliva discharge and intestinal secretions.<sup>[14]</sup>

In our study, removal methods with suture lassoing and tweezers were investigated. In the literature, tick contact cases have been reported to more commonly occur in the June-September period.<sup>[15,16]</sup> Our study also was conducted between May and September. During this period, agriculture and stockbreeding activities are more common compared to other periods of the year, and this increases the risk for tick contact. In our study, 68.8% of the patients who presented to the emergency department due to tick contact were male. In a study by Al et al.,<sup>[17]</sup> this rate was reported as 64%. In a study conducted by Ulug et al.,<sup>[16]</sup> 62% of the patients who presented with a history of tick contact were male. Our result is similar to the previous studies. We think this may be because of the higher involvement of men in agriculture and stockbreeding activities in the region of the study. The majority (77.42%) of the ticks were removed by healthcare professionals, and a lower rate by patients themselves with hand (22.58%). In a similar study from our country, 74% of tick removal was performed by healthcare staff, and 24% by patients themselves.<sup>[16]</sup> Turkish Ministry of Health recommends that if the tick cannot be detached using gloves, clothes or a bag once the tick is noticed by the individuals themselves, they should present to a healthcare center.<sup>[18]</sup> In our study, there were 21 patients who detached the tick



**Figure 3.** Tick break off percentages by the persons who removed them.

themselves following this recommendation. The highest rate of mistake was found with the tick removal by the patients themselves. Of 21 ticks removed by the patients, 53% were broken off.

Tick removal with tweezers is a commonly used method. Complications and risks, such as mousepart break off, have been reported to be lower with this technique.<sup>[19,20]</sup> In a study carried out by Ghirga et al.<sup>[21]</sup> in which the ticks were removed using fishing line thread, 71% of the ticks were completely detached, while mousepart was broken off in 29%. Similarly, in our study, 72% of the ticks were detached as a whole, 16% were broken off, and 12 were detached as a whole, but there was a technical mistake in suture lassoing.

In our study, stages of the ticks were found as a nymph in 17 ticks and adult in 76 ticks. When the correlations between tick stages and technical mistakes were examined, 47% of nymph ticks and 16% of adult tick were broken off. The difference was statistically significant. Given the size of nymph ticks, this was an expected result. On a study by Akin Belli et al.,<sup>[13]</sup> 31% of 80 nymph ticks were broken off. We attribute the difference of our study to the different techniques used.

In conclusion, the results of this study suggest that when appropriately and correctly used, both suture lassoing and tweezers are effective in tick removal. Tick removal should be primarily performed by healthcare professionals. The rate of technical mistakes is significantly lower in ticks detached by healthcare professionals. However, since tick should be removed as soon as possible when noticed, we think that the training of the public on this issue is also important.

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**Conflict of Interest:** None declared.

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ORJİNAL ÇALIŞMA - ÖZET

## Kene çıkartım tekniklerinin değerlendirilmesi ve karşılaştırılması ile kene çıkarma sırasında yapılan teknik hatalar

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**AMAÇ:** Keneler insan ve hayvanların önemli ektoparazitleridir. Keneler insanlara hastalığa neden olan patojenler bulaştırabilir. Kene teması Kırım-Kongo Kanamalı Ateşi dahil olmak üzere çeşitli viral ve bakteriyel enfeksiyonlara yol açabilir. Kenelerin uygun yöntemlerle zamanında çıkarılması hastalık bulaşımının önlenmesi için önemlidir. Kene çıkartım teknikleri hastalığın oluşmasında etkili olabileceği için incelemeye değer bulunmuştur. Çalışmamızda bu tekniklerden ikisi olan kementle çıkarma ve tweezers yöntemlerini değerlendirmek, iki yöntemi karşılaştırmak ve bu yöntemlerle yapılan hataları incelemek amaçlanmıştır.

**GEREÇ VE YÖNTEM:** Bu çalışma ileriye yönelik bir kesitsel çalışma olarak tasarlandı, acil servise kene teması ile başvuran hastalarda sağlık profesyonelleri veya hastaların kendileri tarafından çıkarılan keneyle ilgili olgular yer aldı. Keneler büyüme periyodlarına göre larva, nimf ve yetişkin olarak kaydedildi. Kene çıkartım türleri ve çıkarmada yapılan hatalar kaydedildi.

**BULGULAR:** Kenelerin çoğunluğu (%77.4) sağlık profesyonelleri tarafından, daha düşük bir oranda ise hastaların kendileri tarafından el ile çıkarılmıştı (%22.6). Yetmiş iki hastada (%77.4) herhangi bir hata bulunmadı, kene bir bütün olarak çıkarılmıştı, 15 hastada (%16.1) parçalanmış olarak çıkarılarken, 6 (%6.45) hastada ise kene bir bütün olarak çıkarılmış ancak sütürler yanlış bağlanmıştı. Teknik hatalara bağlı kene parçalanması en çok kişilerin kendi çıkardığı kenelerde görüldü.

**TARTIŞMA:** Bu çalışmanın sonuçları uygun ve doğru bir şekilde uygulandığında hem kement atma hem de tweezers tekniklerinin kene çıkarmada etkili olduğunu göstermiştir. Bu konuda halkın farkındalığını artırma ve eğitim programları artırılmalıdır.

**Anahtar sözcükler:** Kene; kene çıkarma; sütür kement tekniği; tweezers tekniği.

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