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4 **Study of arthroscopic suture repair of torn meniscus**

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11 **Abstract.** To evaluate the results of treatment of meniscus tear injury by arthroscopy and document to
12 establish the influence of age, gender and cause of injury in patients undergoing endoscopic suturing on
13 these results. Study design is in the cross-sectional descriptive method, along track. Method: prospective
14 study. From 7/2006 to 7/2013, we studied 90 patients, from 17 to 50 years old from Thong Nhat
15 hospital (Ho Chi Minh City). All of them were diagnosed with tearing meniscus and were treated
16 arthroscopic meniscus suture by outside-in, inside-out and all inside techniques. Early result, such as
17 evaluating the side effect in surgery and after surgery and result after 6 months of surgery have been
18 collected. Result is as following: over 90 patients in our study, the rate of men accounted for 62.2%,
19 almost 2 times higher for women is 37.8%. The main reason is due to sport a high percentage of 64.7%.
20 The most common age is between 21 and 30 (46.7%). Results after surgery: 32/90 (35.6%) is very
21 good, 52/90 (66%) good, 4/90 (4.4%) medium, 2/90 (2.2%) bad. The indication suture meniscus tear in
22 trauma more attention and give better results on knee function for patients, reducing the long-term
23 complications such as osteoarthritis.

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25 **Key words:** meniscus suture repair; endoscopic suturing; knee trauma; torn meniscus; arthroscopic
26 methods

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31 **INTRODUCTION**

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33 Due to the increasing transportations and sport activities, the number of injuries, especially
34 meniscus one, have been growth significantly. The knee joint is reported to be the most common joint
35 injured by young sports participants. The complexity of the knee joint structure and the
36 multidirectional forces imposed on the knee joint during sporting activities may explain why knee
37 injuries are often more severe than injuries to other body regions. Traumatic torn meniscus (TTM)
38 caused in knee occupied 68 – 75 % of the popular injuries, higher than the torn meniscus caused by
39 other factors (Orengo and Zahlaoui, 1999). The average annual incidence of meniscal injuries per 10
40 thousand inhabitants was 9.0 in males and 4.2 in females (Hede et al., 1990). The TTM often require
41 surgery or extensive rehabilitation before the knee functions at a pre-injury level. The high economic
42 cost of knee injuries to the individual and society is of particular concern in developing countries,
43 where limited access to appropriate services and high healthcare costs are major barriers to
44 appropriate management of youth sports knee injuries. In additional, such knees damages increases
45 the risk of developing osteoarthritis of the knee significantly after 20 years (Vaishya, 2019; Papalia et
46 al., 2019). Moreover, excising of the menisci also leads to developing knee osteoarthritis (OA) and
47 knee deformities such as ridge formation, joint space narrowing, and flattening of the femoral
48 condyle at an increased rate (Fairbank, 1948; Tapper and Hoover, 1969; Roos et al., 1998;). The OA,
49 a degenerative joint disease, is a major public health problem in the general population because it is
50 highly prevalent among the elderly and is associated with considerable disability. OA can affect

51 multiple joints in the body, but it is commonly found in the knee. The recent data from the National
52 Health and Nutrition Examination Survey III reveal that approximately 35% of women and men aged
53 60 years and above had OA of the knee.

54 Although risk factors for prevalence of OA have been well studied in American and European
55 regions, little data are available in Asian populations. According to the latest data in a Chinese
56 population aged ≥ 60 years, the prevalence of knee OA was 22% in men and 43% in women, and this
57 prevalence was 45% higher than that in USA population. In a Japanese rural population, the
58 prevalence of knee OA was 30% in women and 11% in men. Simultaneously, in Vietnam, a country
59 with a population of 90 million, the prevalence of OA has not been studied, but the prevalence of
60 knee pain was 18% among people aged 16 and above. Knee pain and decreased function have been
61 reported at long-term follow-up after partial or total meniscectomy (Tapper and Hoover, 1969).
62 Therefore, meniscal repairs are preferable over partial or total meniscectomies as they aim to restore
63 a functional meniscus and possibly prevent early degenerative changes.

64 A lot of different techniques such as outside-in, inside-out, and all-inside have been described
65 in the literature for the treatment of the menisci tears (Bender et al., 2002; Laupattarakasem et al.,
66 2004; Selby et al., 2007; Miller and Hart, 2005). All of them have as advantages as well as
67 disadvantages. For example, the outside-in technique use for anterior and middle-segment meniscal
68 tears. Simultaneously, the main disadvantage of this technique is that a 1–2 cm skin incision is
69 required, and knots are tied subcutaneously over the capsule (Cho, 2014). The inside-out technique is
70 a novel standard in meniscal surgery. Nevertheless, problems of such method include the need for an
71 accessory incision, and potential injuries to the medial saphenous, peroneal nerve, or lateral popliteal
72 neurovascular bundle (Pettrone, 1982; Johnson and Weiss, 2012). The all-inside technique usually
73 used to repair the posterior horns and middle segments of the meniscus. The arthroscopic all-inside
74 techniques includes pullout suture repair and suture anchor repair. In the same time, for this technique
75 a special meniscal repair device is required, that is expensive (Cuellar et al., 2015; Jenkins et al.,
76 2019).

77 The knee arthroscopy was firstly adopted in the world in 1955 by Watanabe (Dubos, 1999)
78 and since that time has been dramatically developed (Osti et al., 1994; Drago, 2019). Today this
79 method gradually improving and widely applied with many advantages: not only the accurate
80 diagnosis of internal injuries in the knee, but also managed those injuries as well. Patient has reduced
81 hospital stay and get rehabilitation after surgery, quickly returning to normal activities (Martens et
82 al., 1986; Hulet et al., 1999; Frosch et al., 2005; Dürselen et al., 2011). But, meniscus injuries, until
83 now, is still surgical excision. Due to the understanding of blood supply and histopathology of
84 meniscus, it has been shown that meniscus tear can be restored, which helps to reduce postoperative
85 complications such as increased risk of degenerative joint and improve knee function (Metcalf, 1991;
86 Panisset et al., 1999).

87 In Vietnam, before 1994, there are many complications due to open knee surgery. Since 1994,
88 arthroscopy techniques have been applied, but due to the lack of facilities, they are only diagnostic
89 function. In recent years, knee arthroscopy has really grown and achieved encouraging results in the
90 diagnosis and treatment of meniscus injuries. However, there are no study about endoscopic suturing.
91 The purpose of this study was to document to understanding the characteristic of age, gender, cause
92 of injury in patients undergoing endoscopic suturing and evaluating the results of treatment of
93 meniscus tear injury by arthroscopy.

94 95 **MATERIAL AND METHODS**

96 97 **Object of the study**

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99 A number of 90 patients who were diagnosed and treatment by arthroscopic suture in Thong
100 Nhat hospital – Ho Chi Minh city (from July 2006 to July 2013). All the patients agreed to participate
101 in the experiment and do not deny the results of the experiment to be provided in the research paper.
102 All procedures followed were in accordance with the ethical standards of the responsible committee

on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. The minors' parents and guardians do not deny the results of the experiment to be provided in the research paper.

Surgical indications

- The lesion in the 'red-red zone' and the 'red-white zone' (denoting area of vascularity), with younger patients considering treatment in the “white-and-white zone”.
- A new tear under 8 weeks. For younger patients consider torn over 8weeks.
- The age of patient is better under45.

Method of surgery and result evaluating

Meniscal suture technique: Meniscal suture technique depend on lesion and we use inside-out, outside-in, all-inside suture technique.

Result evaluating:

- Early result: Evaluating the side effect in surgery and aftersurgery.
 - Result after 6 months of surgery: follow up after 3 months,6 months base upon Lysholmscore.
- Data processing: SPSS 16.0.

RESULTS AND DISCUSSION

Age and gender

The study groups had a different ratio between male and female, with 62.2% and 37.8% (Table 1). Knee injury cause meniscus tear due to traffic accidents, competing in sport and the percentage of male is higher than female. In fact, women's sport intensity is also lower than manis.

Among our study groups, ages ranging from 17 to 50 years, with an averageage 36.2 years. The most common age is 21 to 30 (46.7%) and 31 to 40 (31.1%). This is also the same age in other studies such as Osti L, Liu SH, Raskin A, Merlo F (Orengo and Zahlaoui, 1999) with the rate of trauma in aged from 17 to 40 is 90%. On the other hand, the mean age of the study was not significantly different when compared with other authors, such as Huletet al.(1999), with an average age 38 years for lateral meniscus and 34 years for medial meniscus. In general, it is more common in active-age patients.

Table 1. Distributing to age and gender.

Gender		Age				Total	
		17-20	21-30	31-40	41-50	N	%
Male	N	4	26	18	8	56	
	%	4.4	28.9	20	8.9		62.2
Female	N	4	16	10	4	34	
	%	4.4	17.8	11.1	4.4		37.8
Total	N	8	42	28	12	90	
	%	8.9	46.7	31.1	13.3		100

The reason of trauma

The cause of sport injuries (62.2%) and traffic accidents (24.4%) is quite high, while other causes such as living activities and other are not (Table 2). Sport injuries are due to lacking of conditions of exercise, patients come to us mainly amateurs and easily got injury. The large number of patients play football. The same history of these case we found that the knee was often injured as rotated lateral too much or rotated and the knee flexion excessively when jumping on the ground. Foreign authors had the patient got injuries mainly due to sports. Randall Cooper et al. (2001) said that the most common mechanism in sport is rotation of foot weight bearing on the ground.

Table 2. Reasons of trauma.

Reason	Traffic accident	Sport	Living activities	Other	Total
N	22	56	8	4	90
%	24.4	62.2	5.5	4	100

The result of knee arthroscopy

There are several ways of evaluating post-operative outcomes. We based on the Lysholm score scale because Lysholm's functional assessment of the wide range motion of knee such as pain, gait, crutches support, knee swelling, stable of knee, climbing stairs and squatting and this scale does not depend on the machine measurement of knee as other methods. The evaluation is easy to reach, suitable for the orthopedic in our country.

Early and long-term results data are presented in Table 3-5. Table 3.

Results obtained before and 3 months after surgery.

Result	Excellent	Good	Moderate	Bad	Total
N	24	58	6	2	90
%	26.7	64.4	6.7	2.2	100

Table 4. Results obtained before and several months after surgery.

Month	6-<9	9-<12	≥ 12	Total
N	4	14	72	90
%	4.4	15.6	80	100

Table 5. Results obtained before and 6 months after surgery.

Result	Excellent	Good	Moderate	Bad	Total
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N	28	56	4	2	90
%	31,1	62.3	4.4	2.2	100

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After 6 months of surgery, 36 patients (40%) improved from moderate to good result

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In summary (Table 6), obtained results revealed that 90 patients, the longest following up to 38 months and the latest is 3 months. We generally gained the result based on the Lysholm score which is as follows: 32/90 (35.6

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%) excellent, 52/90 (66%) good, 4/90 (4.4%) medium and 2/90 (2.2%) bad.

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Table 6. Summary result.

Result		Excellent	Good	Moderate	Bad	Total
Before treatment	N	0	0	44	46	90
	%	0	0	48.9	51.1	100
3 months later	N	24	48	14	4	90
	%	26.7	53.4	15.5	4.4	100
6 months later	N	28	54	6	2	90
	%	31.1	60	6.7	2.2	100
From 12 months	N	32	52	4	2	90
	%	35.6	66	4.4	2.2	100

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Comparing obtained data with previous study, such as Dürselenet al. (2011) and Frosch et al. (2005), the result of our Lysholm scale were slightly lower than those authors; probably patients of ours go to surgery often late and rehabilitation conditions after surgery is not good. In addition, we had a bad outcome of 2.2% (2 patients) because they don't follow the rehabilitation, obesity, deformity and transverse rupture of meniscus, age over 45, pain postoperative lasts for long-term.

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CONCLUSION

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Through 90 patients in the study, we conclude that a better understanding of histopathology, blood supply and progression in knee endoscopic surgery, the indication for suturing arthroscopy of the trauma torn meniscus is increasingly noticeable. Patient had better results in knee function, reducing long-term complications such as osteoarthritis.

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Obtained results demonstrate lower level comparing to the analogues from other investigation probably due to the late surgery and not satisfied rehabilitation conditions after it. Nevertheless, more than 35% of patients have excellent results and more than 65% - good ones. Therefore, we conclude, that proposed endoscopic method could be successfully used as in Vietnam as well as in other countries. For obtaining better and more precisely results more investigations could be completed in the future based on the research results. In additions, authors recommend seeking surgical help as early as possible and undergo complete rehabilitation according to the instructions of doctors.

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AKNOWLEDGEMENT

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The authors are grateful to Thong Nhat Hospital for financial support.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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