Original Article

Delay in surgery predisposes to meniscal and chondral injuries in anterior cruciate ligament deficient knees

Ravi Gupta, Gladson David Masih, Gaurav Chander, Vikas Bachhal

Abstract

Background: Despite improvements in instability after anterior cruciate ligament (ACL) reconstruction, associated intraarticular injuries remain a major cause of concern and important prognostic factor for long term results as it may lead to osteoarthritis. Delay in ACL reconstruction has been in variably linked to increase in these injuries but there is lack of consensus regarding optimal timing of reconstruction. The goal of this study was to investigate delay in surgery and other factors, associated with intraarticular injuries in ACL deficient knees.

Materials and Methods: A total of 438 patients (42 females; 396 males) enrolled for this prospective observational study. The average age of patients was 26.43 (range 17–51 years) years with a mean surgical delay of 78.91 (range 1 week - 18 years) weeks after injury. We analyzed the factors of age, sex, surgical delay, instability, and level of activity for possible association with intraarticular injuries.

Results: Medial meniscus injuries had a significant association with surgical delay (P = 0.000) after a delay of 6 months. Lateral meniscus injuries had a significant association with degree of instability (P = 0.001). Medial-sided articular injuries were significantly affected by age (0.005) with an odds ratio (OR) of 1.048 (95% confidence interval [CI] of 1.014–1.082) reflecting 4.8% rise in incidence with each year. Lateral-sided injuries were associated with female sex (P = 0.018) with OR of 2.846 (95% CI of 1.200–6.752). The level of activity failed to reveal any significant associations.

Conclusion: Surgical delay predicts an increase in medial meniscal and lateral articular injuries justifying early rather than delayed reconstruction in ACL deficient knees. Increasing age is positively related to intraarticular injuries while females are more susceptible to lateral articular injuries.

Key words: Anterior cruciate ligament, chondral damage, meniscal injuries, anterior cruciate ligament tear, knee
MeSH terms: Sports medicine, anterior cruciate ligament, cartilage, knee joint, osteoarthritis

Introduction

The timing of surgical intervention in anterior cruciate ligament (ACL) deficient knees and its effect on other intraarticular injuries have been a matter of considerable interest in the recent years. The incidence of meniscal tears and articular injuries in ACL deficient knees has been reported to be in the range of 39–65% and 17–43%, respectively.[1] However, much higher incidence has been reported in patients who continue the unrestricted activity without ACL reconstruction.[2] These intraarticular injuries have important treatment related and prognostic considerations as it can lead to higher incidence of osteoarthritis.[3] Several authors have reported increasing incidence of meniscal and articular injuries with delay in ACL reconstruction.[4-15] Based on these observations different time limits have been proposed for carrying out the reconstructive procedure; however, there is no universally accepted consensus on these recommendations.[16-19]

Age, sex, surgical delay, sporting activity, and mechanism of injury have also been variably analyzed for association

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with secondary intraarticular injuries in ACL deficient knees; however, the results have not been uniform for all variables,[1,4,5,13] perhaps reflecting of heterogeneity of observed populations. We undertook this study to reflect on these variables and their effect on secondary intraarticular injuries. Our hypothesis was that increase in surgical delay, age, frequency of instability episodes, and level of activity will lead to increase in meniscal and articular injuries.

Materials and Methods

The data for the present study was collected prospectively from patients undergoing arthroscopic ACL reconstruction at a single center from February 2013 to December 2014. All procedures were performed by a senior arthroscopy surgeon (RG) with an extensive experience in sports medicine. All patients presenting to sports injury clinic with ACL deficiency who elected to undergo surgical reconstruction were considered for inclusion in the study. Exclusion criterion was associated Grade 3 injuries of medial/lateral collateral ligaments, posterolateral corner, or posterior cruciate ligament; previous trauma to ipsilateral knee; history of surgery on ipsilateral knee; revision ACL reconstruction; skeletally immature patients; and patients refusing to participate in the study. After detailed counseling, patients were offered immediate/early reconstruction or delayed reconstruction after rehabilitation for 6–8 weeks and were free to choose either approach. All patients had a clinical evidence of ACL deficiency having positive pivot shift and/or Lachman/anterior drawer test which was confirmed with MRI preoperatively. Functional status of all patients was recorded preoperatively by a research fellow using Cincinnati knee score. Surgical delay in each case was clearly documented and divided into six groups (<1.5 months, 1.5–3 months, 3–6 months, 6–12 months, 12–24 months, and >24 months). Furthermore, the patients were divided into three groups depending on the frequency of giving way episodes (none, occasional, or often). Occasional episodes were defined as when they occur only during strenuous/sports activity and episodes occurring often were those which occurred even during routine activities of daily living. We did not record the specific number of episodes of instability as most patients provided a definite response to the general tendency of instability while most were not able to provide a definite number of episodes. The degree of instability was recorded preoperatively using KT-1000 arthrometer. The patients were further divided into three groups depending on the level of activity (nonsports related, amateur-level sports related, and elite-level sports related).

Operative procedure consisted of examination under regional or combined regional and general anesthesia followed by arthroscopic single-bundle ACL reconstruction using quadruple hamstring graft using the previously described technique of author.[20] All intraoperative finding pertaining to condition of ligaments, menisci, and articular cartilage as judged by senior surgeon were recorded by the research fellow at the time of index surgery. Meniscal lesions on medial or lateral side were classified at the time of arthroscopy as bucket handle, longitudinal, horizontal, complex, radial, and complete and flap tear. Articular cartilage lesions were classified according to Outerbridge grading at the time of arthroscopy by the surgeon. The lesions were classified according to location during arthroscopy, as being located in the medial femoral condyle, the lateral femoral condyle, the medial tibial plateau, or the lateral tibial plateau. If more than one lesion was identified in a single anatomical location, only the most severe one was included. This investigation was approved by the institutional ethics committee and informed consent was given by all patients for participation in this study.

Statistical analysis

We used multivariate/multiple binary logistic regression models to study the relationship between dependent variables of meniscal injuries and articular cartilage damage with independent variables of surgical delay, sex, age, level of activity, and frequency of instability. Initially, a bivariate correlation analysis was done to identify potential associations. Hosmer–Lemeshow test was used to validate the model. The categorical independent variable of the surgical delay was contrasted using difference (reverse Helmert contrasts) contrasts while other categorical variables were contrasted using indicator contrast. We had set up the model to provide adjusted odds ratios (ORs) and their 95% confidence limits. Analysis was done using enter method whereby all independent variables were inserted into the model simultaneously. The significant result was defined at the $P = 0.05$. All statistical analysis was carried out using IBM SPSS Statistics 20 software (Chicago, IL).

Results

Four hundred and sixty one patients underwent arthroscopic ACL reconstruction at our center during the study period of which 23 were excluded based on previously defined exclusion criterion. The remaining 438 patients formed the subjects for the present series. Forty two were females while the majority of patients ($n = 396$) were males [Table 1]. The average age of patients was 26.43 years (range 17–51 years). There was a substantial delay in surgery, after initial injury, averaging 78.92 weeks (1 week to 18 years). Hosmer–Lemeshow test[21] was nonsignificant for all comparisons thereby validating goodness of fit for all models.

Meniscal injuries

Medial meniscus

Age, sex, level of activity, or degree of instability were not statistically related to medial meniscus tears; however, the surgical delay was associated significantly with the occurrence of medial meniscal tears [Table 2]. On analysis of different categories, a significant difference was observed after a surgical delay of 6 months, however at 3 months also there was substantially increased incidence of medial meniscal tears which did not reach significant levels ($P = 0.155$).

Lateral meniscus

Sex, age, level of activity, or surgical delay were not statistically related to lateral meniscus tears. The degree of instability revealed a significant association with lateral meniscus tears ($P = 0.001$); however, this difference was observed only for the group which had a maximum frequency of instability [Table 2].

Articular cartilage damage

Medial femoral condyle

Age was highly significant predictor of medial femoral condyle injury ($P = 0.006$) with OR of 1.046 (1.013–1.080) per year. Other predictors of sex, level of activity, degree of instability, and delay in surgery were not associated with medial femoral condyle injuries [Table 3].

Lateral femoral condyle

Female sex was significantly associated with lateral femoral condyle injuries ($P = 0.046$) with OR of 2.541 (1.016–6.358). None of the other predictors were associated with lateral femoral condyle injuries [Table 3].

Medial tibial condyle

Advancing age was the only predictor variable that revealed a significant relation with medial tibial condyle injuries ($P = 0.011$) with OR of 1.082 (95% confidence interval [CI] of 1.018–1.149) indicating 8.2% increase in incidence with each year increase in age [Table 4].

Lateral tibial condyle

Sex was significantly related to lateral tibial condyle injuries ($P = 0.003$) with females having higher odds of injury with OR of 5.671 (95% CI of 1.837–17.508). Advancing age also carried a higher incidence of lateral condylar injuries, but this association failed to reach statistical association ($P = 0.061$; Table 4).

Combined medial articular injuries

Although combining the articular injuries on the medial side of knee remained significant for age with OR of 1.048 (95% CI of 1.014–1.082); however, it failed to reveal any other significant result [Table 5].

Table 1: Demographics and baseline characteristics

Demographic variable	Observation
Age (years)	26.43 (14-51)±6.704
Sex (%)	
Females	42 (9.6)
Males	396 (90.4)
Surgical delay (weeks) (%)	78.91±117.139
≤1.5 months	54 (12.3)
1.5-3 months	63 (14.4)
3-6 months	76 (17.4)
6-12 months	93 (21.2)
12-24 months	62 (14.2)
>24 months	90 (20.5)
Instability (%)	
None	64 (14.6)
Occasional	251 (57.3)
Often	123 (28.1)
Level of activity (%)	
Nonsports related	151 (34.5)
Amateur-level	154 (35.2)
Elite-level	133 (30.4)
Meniscal injuries (%)	
Medial meniscus	200 (45.7)
Lateral meniscus	208 (47.5)
Articular injuries (%)	
Medial femoral condyle	167 (38.1)
Lateral femoral condyle	54 (12.3)
Medial tibial condyle	24 (5.5)
Lateral tibial condyle	26 (5.9)
Medial articular injuries	172 (39.3)
Lateral articular injuries	64 (14.6)
Combined meniscal and articular injuries (%)	
Medial injuries	268 (61.2)
Lateral injuries	226 (51.6)

Table 2: Meniscal injuries

Predictor variable	Medial meniscus		Lateral meniscus	
	P	OR (95% CI)	*P*	OR (95% CI)
Age	0.248	1.019 (0.987-1.053)	0.223	0.980 (0.950-1.012)
Sex	0.149	0.576 (0.272-1.218)	0.775	1.106 (0.554-2.207)
Surgical delay	0.000*		0.051	
	0.560	0.782 (0.343-1.785)	0.357	0.699 (0.327-1.497)
	0.155	1.573 (0.843-2.938)	0.810	0.927 (0.502-1.712)
	0.019	1.885 (1.110-3.201)	0.233	1.378 (0.813-2.334)
	0.000	3.573 (1.985-6.432)	0.338	1.321 (0.747-2.334)
	0.007	1.985 (1.209-3.259)	0.005	2.048 (1.242-3.376)
Instability	0.193		0.001*	
	0.446	1.254 (0.701-2.243)	0.802	1.076 (0.606-1.910)
	0.550	0.821 (0.430-1.568)	0.004	2.535 (1.336-4.812)
Level of activity	0.964		0.140	
	0.945	1.018 (0.607-1.708)	0.750	0.920 (0.553-1.533)
	0.796	1.072 (0.632-1.819)	0.139	1.482 (0.880-2.495)

OR=Odds ratio, CI=Confidence interval, *Statistically significant

Combined lateral articular injuries

Female sex was significantly related to lateral-sided articular injuries ($P = 0.018$) with OR of 2.846 (95% CI of 1.200–6.752). Although surgical delay did not

reveal overall significant association, however, the difference was significant after 6 months ($P = 0.027$) when considering individual categories [Table 5].

Combined meniscal and articular cartilage damage

Medial injuries

Medial injuries were significantly associated with age ($P = 0.004$) with OR of 1.051 (95% CI of 1.016–1.087) and surgical delay ($P = 0.003$). Other variables failed to reveal any significant result [Table 6].

Lateral injuries

The degree of instability as a whole was significantly associated with lateral injuries ($P = 0.011$) which was present with maximal instability similar to the pattern observed for lateral meniscal injuries. Surgical delay was also significantly associated with lateral injuries ($P = 0.022$; Table 6).

Table 3: Femoral condyle

Predictor variable	Medial femoral condyle		Lateral femoral condyle	
	P	OR (95% CI)	*P*	OR (95% CI)
Age	0.006*	1.046 (1.013-1.080)	0.359	1.021 (0.976-1.069)
Sex	0.178	0.593 (0.277-1.268)	0.046*	2.541 (1.016-6.358)
Surgical delay	0.096		0.230	
	0.575	0.798 (0.362-1.757)	0.193	3.004 (0.574-15.725)
	0.540	0.819 (0.432-1.552)	0.117	2.414 (0.803-7.256)
	0.338	1.301 (0.759-2.232)	0.101	2.083 (0.866-5.013)
	0.524	1.209 (0.675-2.165)	0.096	2.032 (0.882-4.679)
	0.007	1.959 (1.202-3.192)	0.060	1.988 (0.971-4.072)
Instability	0.900		0.818	
	0.699	0.891 (0.497-1.599)	0.540	0.772 (0.337-1.767)
	0.913	0.965 (0.507-1.836)	0.584	0.772 (0.305-1.954)
Level of activity	0.837		0.578	
	0.779	1.077 (0.642-1.808)	0.535	1.268 (0.599-2.681)
	0.552	1.175 (0.690-2.000)	0.693	0.851 (0.382-1.897)

OR=Odds ratio, CI=Confidence interval, *Statistically significant

Meniscal injuries versus articular injuries

There was a significant relationship between meniscal tear and articular damage in the same compartment of the knee joint. For medial injuries, articular cartilage damage had an OR of 2.463 (95% CI of 1.620–3.745) in the presence of meniscal tear while on the lateral side the OR was 3.989 (95% CI of 2.136–7.449).

Discussion

ACL injuries are common ligament injuries of the knee joint but despite vast improvements in treatment, an optimal treatment algorithm for these injuries remains a matter of debate.[22] Nevertheless, present understanding of these injuries focuses heavily on the incidence of associated intraarticular injuries and their associations with the delay in surgery. Several authors have reported on these associations; however, results have not always been uniform.[4-15]

We observed a significant association between surgical delay beyond 6 months and damage to medial meniscus. This difference was also observed at 3 months, but it failed to reach statistical significance ($P = 0.155$), possibly due to smaller sample size. Similar observations have been made previously by several authors. Papastergiou *et al*. observed that in ACL deficient knee, prevalence of meniscal tears, especially medial meniscus tears requiring treatment was increased with time.[13] They concluded that ACL reconstruction done within first 3 months postinjury was an effective way of reducing secondary meniscal tears. Church and Keating reviewed 183 patients who had undergone ACL reconstruction and concluded that ACL reconstruction should be carried out within 12 months postinjury to minimize the risk of meniscal

Table 4: Tibial condyle

Predictor variable	Medial tibial condyle		Lateral tibial condyle	
	P	OR (95% CI)	*P*	OR (95% CI)
Age	0.011*	1.082 (1.018-1.149)	0.061	1.060 (0.997-1.126)
Sex	0.362	0.372 (0.045-3.116)	0.003*	5.671 (1.837-17.508)
Surgical delay	0.463		0.129	
	0.997	53,077,499.022 (0.000–.)	0.245	3.828 (0.398-36.851)
	0.997	7744.076 (0.000–.)	0.431	0.394 (0.039-3.995)
	0.997	512.629 (0.000–.)	0.180	2.607 (0.642-10.576)
	0.997	209.066 (0.000–.)	0.034	3.646 (1.102-12.067)
	0.997	85.271 (0.000–.)	0.014	3.677 (1.304-10.365)
Instability	0.870		0.266	
	0.598	0.717 (0.208–2.470)	0.498	0.678 (0.220-2.089)
	0.717	0.780 (0.204–2.989)	0.114	0.314 (0.075-1.322)
Level of activity	0.293		0.995	
	0.121	0.381 (0.112–1.289)	0.947	1.038 (0.343-3.144)
	0.727	0.827 (0.285–2.404)	0.968	0.977 (0.321-2.974)

OR=Odds ratio, CI=Confidence interval, *Statistically significant

Table 5: Combined articular injuries

Predictor variable	Medial articular injuries		Lateral articular injuries	
	P	OR (95% CI)	*P*	OR (95% CI)
Age	0.005*	1.048 (1.014-1.082)	0.101	1.036 (0.993-1.081)
Sex	0.120	0.546 (0.255-1.171)	0.018*	2.846 (1.200-6.752)
Surgical delay	0.064		0.067	
	0.568	0.794 (0.360-1.752)	0.126	3.570 (0.699-18.228)
	0.669	0.870 (0.461-1.645)	0.160	2.188 (0.734-6.520)
	0.354	1.290 (0.752-2.213)	0.027	2.568 (1.112-5.930)
	0.274	1.380 (0.775-2.458)	0.018	2.568 (1.177-5.602)
	0.005	2.013 (1.235-3.283)	0.029	2.128 (1.079-4.198)
Instability	0.982		0.642	
	0.870	0.952 (0.530-1.710)	0.501	0.768 (0.356-1.658)
	0.960	0.983 (0.516-1.873)	0.347	0.655 (0.271-1.581)
Level of activity	0.958		0.574	
	0.943	0.981 (0.586-1.643)	0.454	1.312 (0.645-2.669)
	0.839	1.056 (0.622-1.795)	0.814	0.914 (0.432-1.935)

OR=Odds ratio, CI=Confidence interval, *Statistically significant

Table 6: Combined meniscal and articular injuries

Predictor variable	Combined medial injuries		Combined lateral injuries	
	P	OR (95% CI)	*P*	OR (95% CI)
Age	0.004*	1.051 (1.016-1.087)	0.496	0.989 (0.958-1.021)
Sex	0.118	0.574 (0.286-1.150)	0.122	1.729 (0.863-3.463)
Surgical delay	0.003*		0.022*	
	0.795	0.906 (0.430-1.909)	0.899	0.952 (0.450-2.017)
	0.796	1.082 (0.596-1.964)	0.981	0.993 (0.544-1.811)
	0.182	1.431 (0.846-2.421)	0.296	1.321 (0.784-) 2.225
	0.004	2.481 (1.338-4.600)	0.158	1.504 (0.853-2.653)
	0.006	2.174 (1.248-3.787)	0.001	2.274 (1.372-3.769)
Instability	0.697		0.011*	
	0.972	1.011 (0.559-1.828)	0.967	0.988 (0.560-1.745)
	0.577	0.831 (0.433-1.595)	0.039	1.956 (1.035-3.698)
Level of activity	0.414		0.245	
	0.277	1.341 (0.791-2.273)	0.785	1.073 (0.646-1.783)
	0.219	1.403 (0.818-2.407)	0.123	1.506 (0.894-2.537)

OR=Odds ratio, CI=Confidence interval, *Statistically significant

tears and degenerative changes.[11] Murrell *et al*. observed six-fold increase in cartilage loss and three-fold increase in meniscal loss with delay of more than 2 years compared to <2 months delay.[14] Tandogan *et al*. had concluded that the frequency of medial meniscus tears and chondral lesions increases with time from initial injury.[5] Chhadia *et al*. had concluded that longer time to surgery increased the risk of medial meniscus injury, cartilage injury, decreased meniscal repair rate, and increased ACL injuries with concomitant meniscal and cartilage injury pattern.[7] The incidence of lateral meniscus injury remained fairly constant with delays in treatment and we were unable to find a significant association between the two variables. This observation is in agreement with most published series, although Tandogan *et al*. and Yüksel *et al*. have observed that delay in surgery was associated with both medial as well as lateral meniscal injuries while Michalitsis *et al*. and Kluczynski *et al*. failed to observe any relationship between surgical delay and meniscal injuries.[2,5,10,12] Several biomechanical studies have observed increased forces in medial meniscus under loading of the knee joint after removal of ACL, thus validating the observation of increased incidence of medial meniscal surgical delay.[23,24]

In the present series, the incidence of lateral meniscus injuries was associated with the degree of instability. This observation has not been made previously and the only other study to report on the effect of instability on associated knee injuries in ACL deficient knee reported on the actual number of instability episodes. This study concluded that more instability episodes predicted the incidence of medial meniscus tear and its management.[12] Furthermore, they observed no relationship between time delay and medial meniscal injuries after adjusting for a number of instability episodes which is in contrast to the observations made in the majority of reports. Surgical delay was not significantly related to any individual site of cartilage injury; however, after combining lateral and medial-sided cartilage injuries, association was significant at a delay of 6 months and beyond ($P = 0.027$) on the lateral side [Table 5]. Similar observations have been made by Chhadia *et al*. and Tandogan *et al*. while considering chondral lesions as a single group.[5,7] While making a similar comparison for all cartilage injuries together, we also observed a significant association ($P = 0.043$).

The possible explanation for this pattern of association of medial meniscus and lateral articular injuries with surgical delay can be explained by the fact that lateral meniscus is more mobile which can protect it from injury but which might expose the underlying cartilage to injury while medial meniscus is less mobile which exposes it to more frequent injuries.[6]

Similar to the observations made by Fok and Yau we observed a significant association of age ($P = 0.002$) with an overall incidence of cartilage injury.[1] However, age was not statistically significantly related to lateral femoral condyle ($P = 0.126$) or lateral tibial condyle ($P = 0.061$) injuries while being related to medial femoral condyle ($P = 0.001$) and medial tibial condyle ($P = 0.011$) injuries. This pattern was similarly observed after combining femoral and tibial injuries on either side [Table 5].Overall, cartilage injuries had OR of 1.052 (95% CI of 1.018–1.086) suggesting 5.2% increase in chondral injuries with each year increase in age. Slauterbeck *et al*. made a similar observation with the association of medial meniscus tear and medial femoral condyle injuries with age beyond 35 years.[4] Similar to observations of Fok and Yau, Yüksel *et al*., and Kluczynski *et al*., we did not find any significant associations of age with meniscal injuries.[1,2,12] However, this is in contrast to some other reports where such association has been found to be significant.[4,7]

Although sex as a predictor of intraarticular injuries in ACL deficient knees has been studied by several authors; however, the outcome reported has been variable. Kluczynski *et al*. reported a higher incidence of meniscal injuries in men while chondral damage was not related to sex.[12] Chhadia *et al*. reported a decreased incidence of lateral meniscal tear and chondral damage for female patients.[7] Fok and Yau, on the other hand, did not find any association of sex with intraarticular injuries.[1] In the present series, we failed to observe any such association for meniscal injuries; however, female sex was related to lateral femoral condyle ($P = 0.046$), lateral tibial condyle ($P = 0.003$), and combined lateral articular injuries ($P = 0.018$). Although medial-sided injuries did not show statistically significant association with sex; however, injuries on medial side tended to occur more often in males [Tables 3-5]. We are not aware of similar observation regarding the different pattern of chondral damage among males and females being reported earlier. However, these observations can be explained by the possibility of a different mechanism of noncontact ACL injuries in females compared to males where valgus moment torque might play a major role.[25] Moreover, the pattern of injuries can certainly vary among reports on different population and regions. While the report of Fok *et al*. is from an Asian population, other cited reports are from North America which may explain such difference in observations regarding gender association.

We analyzed for the level of activity as a predictor variable, but it did not reveal an association with any dependent variables. Similar trends have been reported previously by Kluczynski *et al*.[12] We observed a significant relationship of articular cartilage damage with meniscal injury of same compartment of the knee, which is in agreement with the observations made by Fok and Yau.[1] We also looked for such relationship with subset of patients with high grade (Grade 3 and 4) articular damage but observed similar association only for lateral cartilage injuries.

The decision regarding timing and necessity of surgical treatment of ACL deficient knees remains a disputed topic. Due to lack of clear guidelines, most surgeons individualize treatment based on clinical symptoms, age, and patient's occupation. Several reports in past have tried to resolve this issue which has resulted in trends toward earlier reconstructions.[22] However, these reports are based on arthroscopy and have potential of selection bias for patients opting for surgical treatment after failed initial nonoperative treatment. Moreover, reports concentrating on the incidence of intraarticular injuries in patients treated nonoperatively are lacking for adult population perhaps due to ethical issues of using diagnostic arthroscopy or serial MRI in asymptomatic individuals. Furthermore, it remains unknown if the early surgical reconstruction of ACL deficient knees can prevent these intraarticular injuries with increasing time.[22] Despite reporting a higher incidence of meniscal injuries with the delay in surgery, a recent level 1 randomized controlled trial, based on functional scores, concluded that early ACL reconstruction is not superior to delayed optional ACL reconstruction.[15] This conclusion has since been challenged by several authors.[17-19] Notwithstanding these arguments, most reports uniformly state that incidence of articular injuries increases with the delay in surgical treatment. We made a similar observation and agreed with the recommendation of early reconstruction. Another important observation of this study, seldom reported before, is the effect of degree of instability on lateral meniscal injuries which supports the practice of including this parameter in the decision-making process.

We acknowledge certain limitations in the present series including the highly skewed ratio of female to male patients which can introduce beta error for certain observations made regarding gender difference in the pattern of associated injuries in ACL deficient knees. Another limitation is the relatively small sample size as compared to some previous report.

Conclusion

In view of increase in the incidence of medial meniscal and lateral articular cartilage injuries, we concur with the recommendation of previous authors that ACL reconstruction should preferably be performed within 3 months. The degree of instability is perhaps another parameter of significance while deciding for surgical treatment in ACL deficient knees as it can affect the incidence of lateral meniscal injuries.

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Conflicts of interest

There are no conflicts of interest.

References

1. Fok AW, Yau WP. Delay in ACL reconstruction is associated with more severe and painful meniscal and chondral injuries. Knee Surg Sports Traumatol Arthrosc 2013;21:928-33.
2. Yüksel HY, Erkan S, Uzun M. The evaluation of intraarticular lesions accompanying ACL ruptures in military personnel who elected not to restrict their daily activities: The effect of age and time from injury. Knee Surg Sports Traumatol Arthrosc 2006;14:1139-47.
3. von Porat A, Roos EM, Roos H. High prevalence of osteoarthritis 14 years after an anterior cruciate ligament tear in male soccer

players: A study of radiographic and patient relevant outcomes. Ann Rheum Dis 2004;63:269-73.
4. Slauterbeck JR, Kousa P, Clifton BC, Naud S, Tourville TW, Johnson RJ, *et al.* Geographic mapping of meniscus and cartilage lesions associated with anterior cruciate ligament injuries. J Bone Joint Surg Am 2009;91:2094-103.
5. Tandogan RN, Taser O, Kayaalp A, Taskiran E, Pinar H, Alparslan B, *et al.* Analysis of meniscal and chondral lesions accompanying anterior cruciate ligament tears: Relationship with age, time from injury, and level of sport. Knee Surg Sports Traumatol Arthrosc 2004;12:262-70.
6. Maffulli N, Binfield PM, King JB. Articular cartilage lesions in the symptomatic anterior cruciate ligament-deficient knee. Arthroscopy 2003;19:685-90.
7. Chhadia AM, Inacio MC, Maletis GB, Csintalan RP, Davis BR, Funahashi TT. Are meniscus and cartilage injuries related to time to anterior cruciate ligament reconstruction? Am J Sports Med 2011;39:1894-9.
8. Granan LP, Bahr R, Lie SA, Engebretsen L. Timing of anterior cruciate ligament reconstructive surgery and risk of cartilage lesions and meniscal tears: A cohort study based on the Norwegian National Knee Ligament Registry. Am J Sports Med 2009;37:955-61.
9. Yoo JC, Ahn JH, Lee SH, Yoon YC. Increasing incidence of medial meniscal tears in nonoperatively treated anterior cruciate ligament insufficiency patients documented by serial magnetic resonance imaging studies. Am J Sports Med 2009;37:1478-83.
10. Michalitsis S, Vlychou M, Malizos KN, Thriskos P, Hantes ME. Meniscal and articular cartilage lesions in the anterior cruciate ligament-deficient knee: Correlation between time from injury and knee scores. Knee Surg Sports Traumatol Arthrosc 2015;23:232-9.
11. Church S, Keating JF. Reconstruction of the anterior cruciate ligament: Timing of surgery and the incidence of meniscal tears and degenerative change. J Bone Joint Surg Br 2005;87:1639-42.
12. Kluczynski MA, Marzo JM, Bisson LJ. Factors associated with meniscal tears and chondral lesions in patients undergoing anterior cruciate ligament reconstruction: A prospective study. Am J Sports Med 2013;41:2759-65.
13. Papastergiou SG, Koukoulias NE, Mikalef P, Ziogas E, Voulgaropoulos H. Meniscal tears in the ACL-deficient knee: Correlation between meniscal tears and the timing of ACL reconstruction. Knee Surg Sports Traumatol Arthrosc 2007;15:1438-44.
14. Murrell GA, Maddali S, Horovitz L, Oakley SP, Warren RF. The effects of time course after anterior cruciate ligament injury in correlation with meniscal and cartilage loss. Am J Sports Med 2001;29:9-14.
15. Frobell RB, Roos EM, Roos HP, Ranstam J, Lohmander LS. A randomized trial of treatment for acute anterior cruciate ligament tears. N Engl J Med 2010;363:331-42.
16. Frobell RB, Roos HP, Roos EM, Roemer FW, Ranstam J, Lohmander LS. Treatment for acute anterior cruciate ligament tear: Five year outcome of randomised trial. BMJ 2013;346:f232.
17. Richmond JC, Lubowitz JH, Poehling GG. Prompt operative intervention reduces long term osteoarthritis after knee anterior cruciate ligament tear. Arthroscopy 2011;27:149-52.
18. Lawrence JT, Argawal N, Ganley TJ. Degeneration of the knee joint in skeletally immature patients with a diagnosis of an anterior cruciate ligament tear: Is there harm in delay of treatment? Am J Sports Med 2011;39:2582-7.
19. Bernstein J. Early versus delayed reconstruction of the anterior cruciate ligament: A decision analysis approach. J Bone Joint Surg Am 2011;93:e48.
20. Gupta RK, Aggarwal S, Aggarwal V, Garg SK, Kumar S. Preserved insertions of the semitendinosus and gracilis tendons (STG) in ACL reconstruction: A new surgical technique with preliminary results. Current Orthopaedic Practice 2010;21 (4):409-14.
21. Hosmer DW, Lemeshow S. Goodness of fit tests for the multiple logistic regression model. Communications in Statistics 1980; 9:1043-1069.
22. Delincé P, Ghafil D. Anterior cruciate ligament tears: Conservative or surgical treatment? A critical review of the literature. Knee Surg Sports Traumatol Arthrosc 2012;20:48-61.
23. Markolf KL, Jackson SR, McAllister DR. Force measurements in the medial meniscus posterior horn attachment: Effects of anterior cruciate ligament removal. Am J Sports Med 2012;40:332-8.
24. Jiang W, Gao SG, Li KH, Luo L, Li YS, Luo W, *et al.* Impact of Partial and complete rupture of anterior cruciate ligament on medial meniscus: A cadavaric study. Indian J Orthop 2012;46:514-9.
25. Quatman CE, Hewett TE. The anterior cruciate ligament injury controversy: Is "valgus collapse" a sex-specific mechanism? Br J Sports Med 2009;43:328-35.