The National Ligament Registry

2015 Annual Report

NATIONAL LIGAMENT REGISTRY

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1 Introduction

The UK National Ligament Registry (NLR) is designed to collect and store outcome data relating to anterior cruciate ligament reconstruction surgery. It was launched at the BASK annual scientific meeting in 2013. Any data collection system must be established to answer clear questions. A simple aim, but hard when trying to predict future issues. Simple questions need robust systems to provide valid answers. For this very reason, we have concentrated on a single procedure, primary anterior cruciate ligament (ACL) reconstruction, and we are confident that the results will benefit future surgeons and patients alike. When established it will ease the journey for similar pathways for the revision of ACL procedures, non-operative treatment of ACL rupture and other ligament reconstructions.

The NLR will only succeed if all partners (patients, surgeons and industry) are involved, feel valued and benefit. The Registry is established as a surgeon led entity without the initial involvement of governmental agencies. This approach therefore requires external financial support and we have received sponsorship from 8 companies involved in ACL reconstruction as well as a 'priming' grant from BASK. In return, the companies will be provided with information on the performance of their particular products, but will not be able to access raw data. We need surgeon support to ensure we achieve a critical number of surgeons and procedures.

The population undergoing ACL reconstructions are typically younger, more mobile and busy. This makes them difficult to track that is why two of the key elements of information are the NHS number and an email address. This is the electronic age and email and text communication is the norm and must be acknowledged. It will take some effort and vigilance to enter patients but with automated follow up the process is simple and appealing.

In understanding outcome following ligament reconstruction it is important to analyse all relevant factors that may be considered to affect outcome including graft choice, surgical/fixation techniques, patient factors and rehabilitation factors. The outcome measures chosen are the knee injury and osteoarthritis outcome score (KOOS), subjective International Knee Documentation Committee (IKDC), Euroqol (EQ5D) and the Tegner activity score. These scores allow comparison and communication with existing Registries as well as allowing potential 'generic health benefit' comparisons to other non-Orthopaedic procedures. With the NLR, surgeons should strive to achieve the primary aim of a (complete) database of the 'functional' outcome of ACL reconstruction in the UK — it will then enable some secondary gains which could include uses in surgeon revalidation and the establishment of a platform to allow the controlled introduction of new products.

Registry data provides a substantial amount of information directed towards answering questions and raising overall standards of care, for the benefit of patients, clinicians, the NHS and industry. The Steering group would like to thank all of who contributed to the NLR thus far, and hope that this report provides a useful summary of progress to date.

2 Aim of Registry

When understanding outcomes following ligament reconstruction, it is important to analyse all relevant factors that may have an effect. This could be anything from graft choice and surgical fixation, to patient factors and rehabilitation factors. The registry aims to:

- Collect relevant demographic data
- Identify any current or emerging trends in practice
- Identify failing techniques / devices at the earliest opportunity
- Provide functional outcome data and complication rates
- Improve the standard and quality of care in the UK as a result of all of the above

Currently, there is a lack of information regarding the number of procedures, functional outcome and complication rate following ACL reconstruction (ACLR) operations in the UK. The Registry aims to address this gap, creating standard best practice approaches and one central hub of clear and concise data. We hope this will:

- Help patients (and surgeons) understand the outcome
- Identify standards of practice
- Identify techniques / implants that do not excel
- Provide information to commissioners to guide the production of a high value pathway

3 Background

The UK National Ligament Registry has been designed by surgeons for the benefit of patients. It is an exciting collaborative project, significantly contributing to understanding the outcome following anterior cruciate ligament reconstruction. At the time of writing we have 304 registered surgeons who will be defined as the enthusiasts. This is already a huge endorsement for the early phase of this project. This number should steadily increase as surgeons and orthopaedic departments see the advantage of having a readymade tool for use in governance and revalidation.

The Registry is a user-friendly web based platform that collects various outcome data from ACL reconstruction operations. The Registry platform is easily accessible via computer and tablet, simplifying the process for clinicians and patients. The ‘registry route’ is simple, requiring small contributions from both surgeon and patient at different stages. It also automatically prompts patients to fill in their information at scheduled times of treatment and rehabilitation, taking the hassle and stress out of clinical data collection for clinicians. At the time of writing we have 3000 registered patients and 17800 completed patient forms. Bluespier was selected as the company to collect and host the data utilising their newly developed Amplitude system. With their help, we have established a new model for this Registry which involves automated online (paperless) data entry. It enables surgeons, patients and support staff to access/register online in a straightforward manner with easy access guidelines.

The data from the NLR is managed by the surgeons who input their patients. Backed by industry partner support, it will be overseen by the NLR steering group and a ‘general manager’, producing an independent annual report. There will also be a research subcommittee appointed through the NLR steering group, with responsibility for deciding direction of research and managing data requests from external parties. The program will be run and technically supported by Amplitude, experts in collecting clinical outcomes data.
4. Results from Current data (2012-2015)

4 Results from Current data (2012-2015)

4.1 Age at Surgery

A total of 2,854 ACLR procedures were registered in the national ligament register between December 2012 and February 2015. The average age for patients undergoing ACLR was 30. This reflects the increase in ACLR surgery in older age group. Around 19% of patients who underwent ACLR surgery were above the age of 40. This could be attributed to the increased sports participation in this age group with patients performing high level-athletic activities longer in life that predisposes them to ACL injury. Figure (1) demonstrates the number of patients who had ACLR surgery in different age groups.

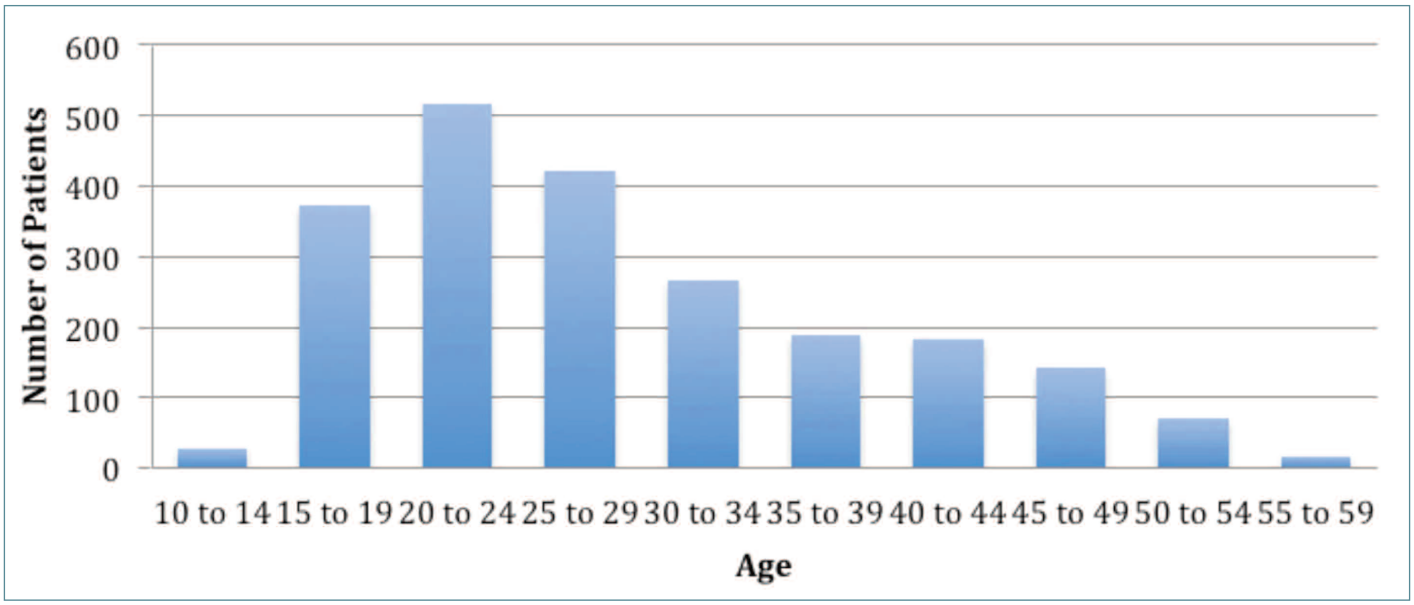

Figure 1: Number of patients who underwent primary ACLR procedures according to their age at time of surgery

4.2 Gender distribution

The percentage of men and women who underwent ACLR surgery were 75% and 25% respectively with a male to female ratio of 3:1 (Figure 2). Figure (3) shows the distribution of male and female patients who underwent ACL surgery between 2012 and 2015. The average age for women who had ACL surgery was 37 while it was 31 in men. The distribution of male and female in different age groups is shown in Figure (4). Interestingly, it shows that more women underwent ACL surgery above the age of 50 compared to men.

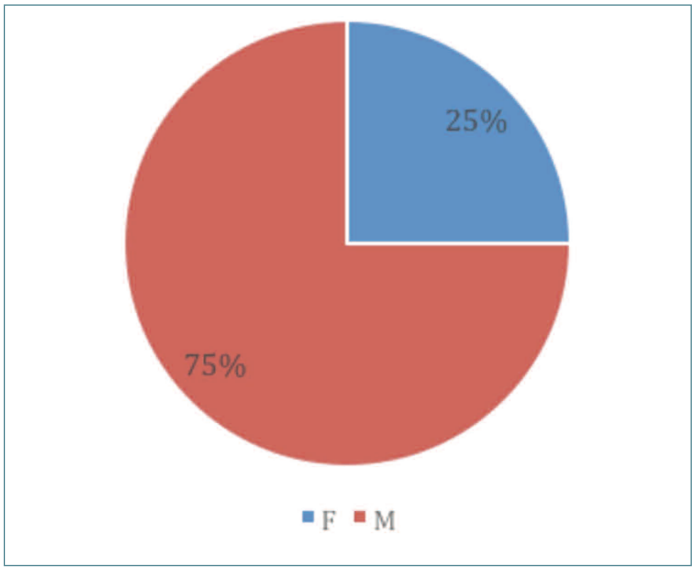

Figure 2: Percentage of male and female who underwent ACLR surgery

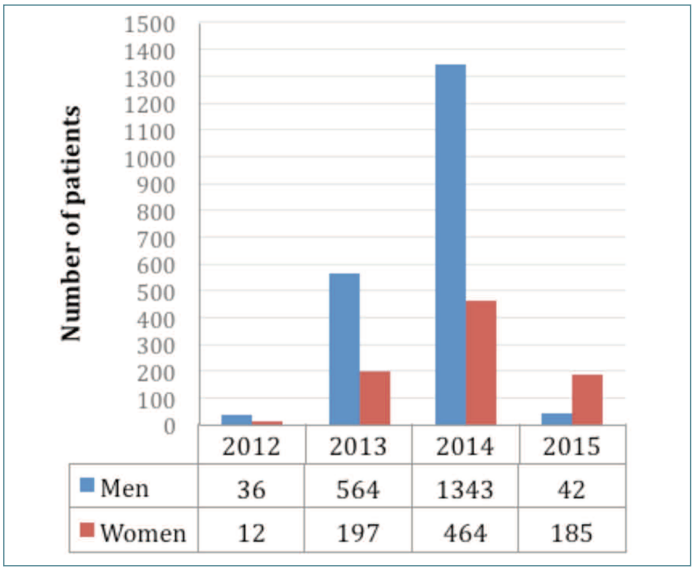

Figure 3: The distribution of male and female patients who underwent ACLR surgery between the end of 2012 till February 2015

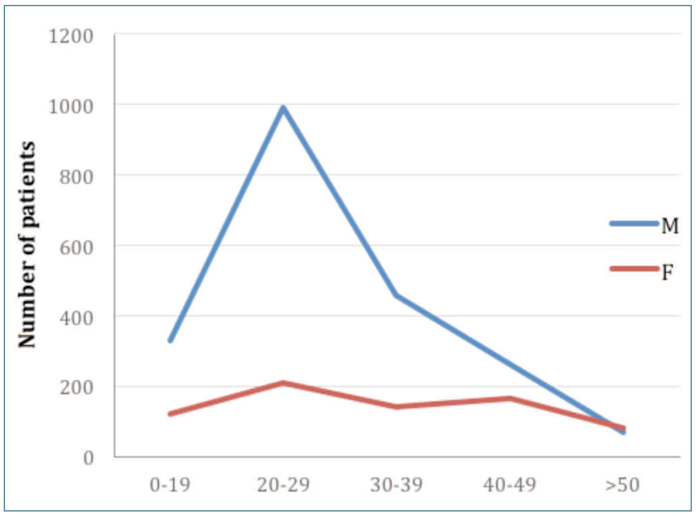

Figure 4: Distribution of male and female patients who underwent ACLR surgery in different age groups

4.3 Operated Side

The right knee was operated upon in 54% of patients who underwent ACLR surgery while it was the left knee in 46% of patients (Figure 5).

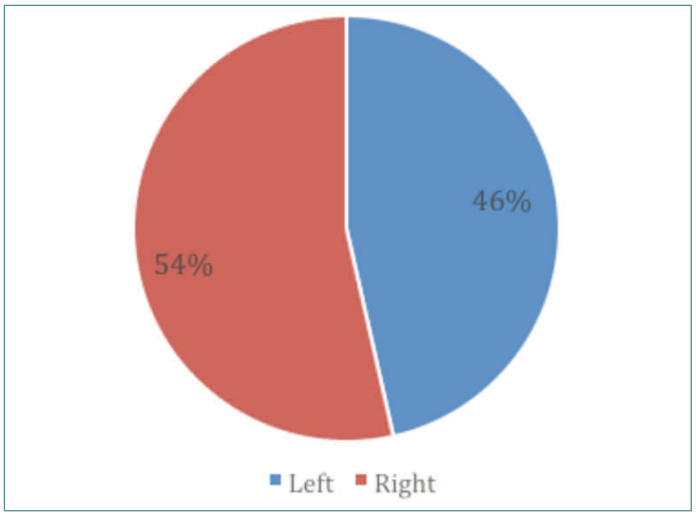

Figure 5: Operating Side

4.4 BMI distribution

Figure (6) describes the body mass index (BMI) ranges for patients who underwent ACLR procedures. Around 45% of the patients had BMI values between 18.5 and 25 while 3% were over 35.

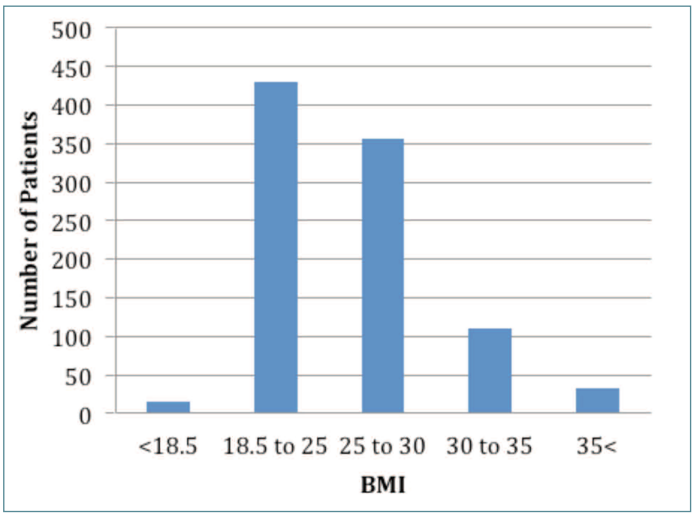

Figure 6: BMI ranges for patients who underwent ACLR procedures. Data from a total of 944 patients were available for analysis.

4.5 Activity in Association with the ACL injury

Sport injuries are the leading cause for ACL tears. This is particularly common in pivoting and cutting sports. Out of 2854 patients, 1086 have answered the question on the activity leading to their ACL injury. 87% of those that answered did sustain their ACL injury while engaged in sports activities while 13% sustained their ACL injury due to non-sport activities. Football (soccer) was the most common activity associated with an ACL injury. Among men, the second most common activities associated with ACL injury were rugby followed by snow skiing. However, snow skiing was the most common activity associated with an ACL injury in women followed by netball and football (soccer). Table (1) shows the sport activities in relation to the ACL injuries in men and women. Table (2) shows the various non-sport activities that lead to ACL injury. Over one third of these patients reported having a fall as the cause for their ACL injuries.

Table 1: Distribution of sport activities as the cause for ACL injuries in men and women

	Total	M	F	%
Football (Soccer)	470	449	21	41.92
Rugby	145	127	18	12.93
Snow Skiing	92	23	69	8.20
Other	48	33	15	4.28
Netball	35	0	35	3.12
Gaelic Games	21	18	3	1.87
Hockey (Field Hockey)	19	11	8	1.69
Martial Arts	13	9	4	1.15
Horse riding	10	0	10	0.89
Running	9	7	2	0.80
Skate Boarding	9	6	3	0.80
Trampolining	8	0	8	0.71
Badminton	7	3	4	0.62
American Football	6	6	0	0.53
Basketball	6	3	3	0.53
Cycling (Mountain Bike)	6	6	0	0.53
Squash	6	5	1	0.53
Tennis	6	1	5	0.53
Cricket	5	4	1	0.44
Gymnastics	5	2	3	0.44
Judo	4	3	1	0.35
Boxing	3	3	0	0.26
Wrestling	2	2	0	0.17
Athletics – Field	1	0	1	0.08
Cycling (Road bike)	1	0	1	0.08
Golf	1	1	0	0.08
Hockey (Ice Hockey)	1	1	0	0.08
Volley Ball	1	1	0	0.08
Water Skiing	1	0	1	0.08

Table 2: Distribution of non-sport activities as the cause for ACL injuries in men and women

	Total	M	F	%
I had a Fall	55	28	27	38.73
Other	45	23	22	31.69
Work related injury	13	13	0	9.15
Dance	8	2	6	5.63
Motor Bike (Traffic accident)	8	6	2	5.63
Assault	5	2	3	3.52
Motor Bike (Off road)	4	3	1	2.81
Motor Vehicle (Traffic accident)	4	0	4	2.81

4.6 Associated knee injuries with ACL tears

Of the 2,854 patients who had ACLR surgery 37% had associated knee injuries that required surgical treatment. Medial meniscus surgery including partial menisectomy and meniscal repair were the commonest associated surgery (14%). The second common associated procedure was lateral meniscus surgery (11%). Combined medial and lateral meniscus surgeries were undertaken in 4.8% of the patients. Table (3) shows a breakdown of patients who had knee surgery associated with ACLR procedures.

Table 3: Incidents of ACLR and associated surgery. Number of patients is presented in the first column. Tick sign represents the associated injury or combination of injuries.

Number	ACL	CL	PCL	ALL	PLC	MM	LM	Articular cartilage	Lateral tenodesis	Other
1794	✓									
412	✓					✓				
313	✓						✓			
137	✓					✓	✓			
48	✓							✓		
24	✓									✓
19	✓	✓								
17	✓				✓					
17	✓					✓		✓		
15	✓									✓
15	✓					✓	✓	✓		
8	✓						✓	✓		
7	✓	✓					✓			
6	✓			✓						
4	✓					✓			✓	
3	✓								✓	
3	✓	✓				✓				
2	✓						✓		✓	
2	✓	✓						✓		✓
1	✓		✓							
1	✓					✓	✓		✓	
1	✓				✓	✓				
1	✓	✓				✓	✓			
1	✓							✓		✓
1	✓						✓	✓		✓
1	✓	✓	✓							
1	✓			✓		✓		✓		

4.7 Funding Sources

The National Health Service (NHS) has funded 80% of the ACLR surgery recorded in the NLR. The remaining 20% was funded independently (Figure 7)

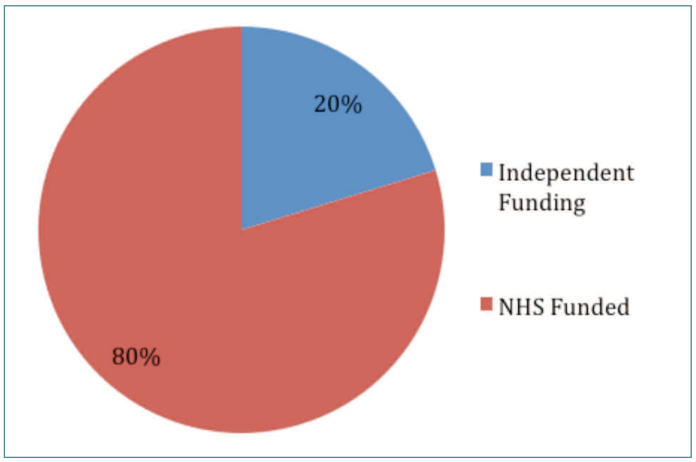

Figure 7: Funding sources for ACLR procedures

4.8 Time to surgery

The average time between ACL injury and the surgical reconstruction was 359 days. Although this might appear as a long period between injury and surgery, it is similar to what has been reported by the Scandinavian registries. The reason for such a long period is unknown. Possible explanations include delayed diagnosis; long surgical waiting lists and lengthy rehabilitation program for patients who were initially managed non-operatively.

4.9 Surgeons' Profile

Between 2012 and 2015, 155 surgeons have registered their patients on the NLR. Figure (8) demonstrates the number of surgeon in relation to the total ACLRs procedure they have performed in 2014. Forty three surgeons performed 10 or less ACLR surgery while six surgeons performed 100 or more ACLR procedures. Figure (9) shows the grades of operating surgeons who performed the ACLR surgery. Around 90% of ACLR surgery has been performed by consultant grade surgeons.

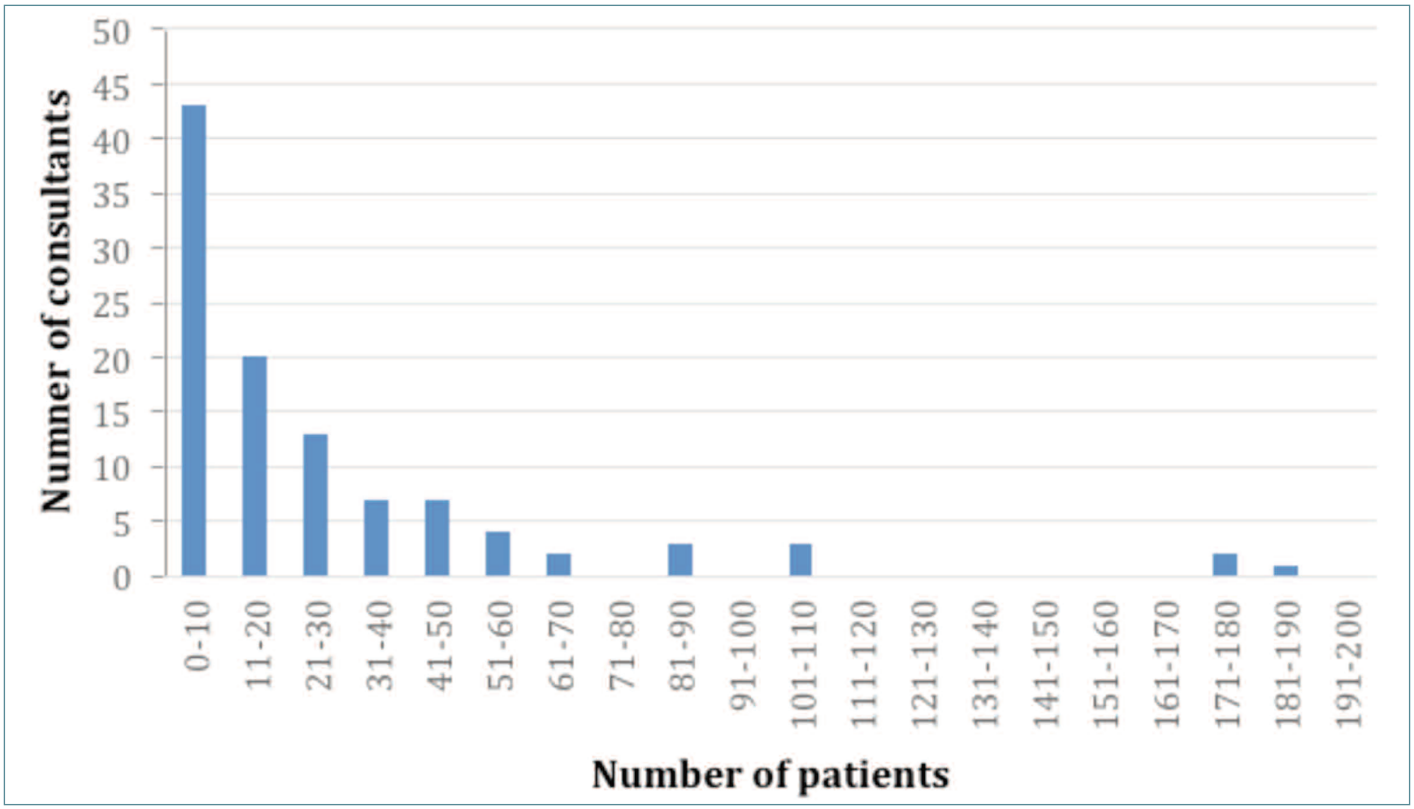

Figure 8: Number of surgeons in relation to the total ACLRs procedures they performed in 2014

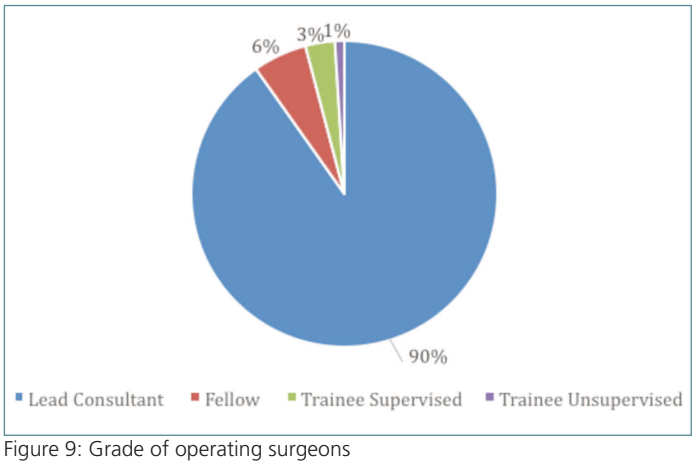

Figure 9: Grade of operating surgeons

4.10 Graft type

Autograft was the most common graft choice in ACLR procedures (98.5%). Allograft was used in primary ACLR surgery in 1% of the patients. Synthetic graft was used in six patients only. Three patients underwent direct suture repair for the ACL tear instead of reconstruction procedure (Figure 10).

Hamstring tendon autograft was the graft of choice in the majority of patients who underwent ACLR procedures. A doubled semitendinosus and gracilis graft was the most commonly used autograft (81%) followed by semitendinosis alone (12%) and patellar tendon (7%). Quadriceps tendon autograft was used in three patients only (Figure 11).
The hamstring tendon autograft can be used in a single- or multi-strands configuration. Four-strands configuration was the most common (82%) followed by five-strands configuration (9%). Single-strand configuration was used in four patients only (Figure 12).

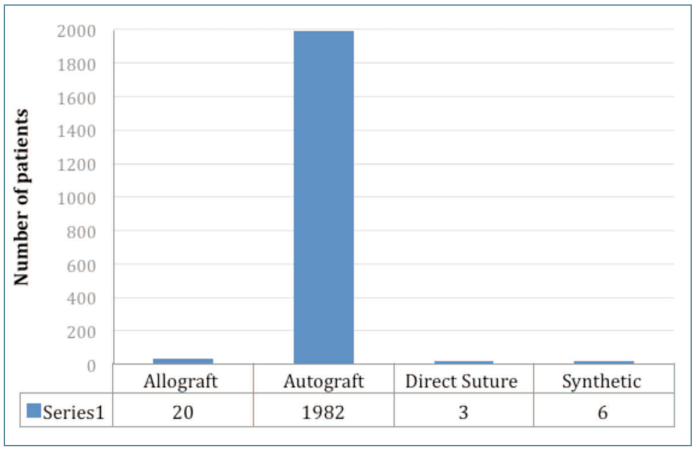

Figure 10: Type of ACL Graft. Data from a total of 2011 patients were available for analysis

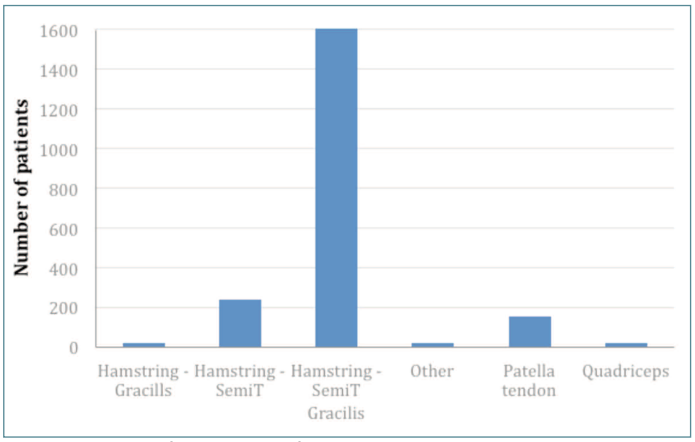

Figure 11: Types of ACL autograft

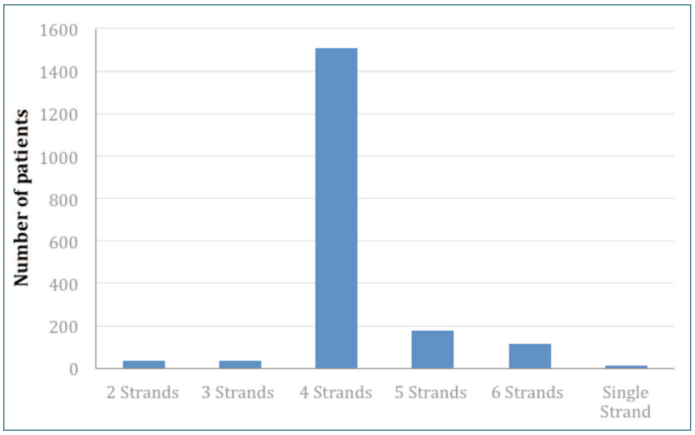

Figure 12: Hamstring tendon autograft doubling configurations

4.11 Graft diameter

The most common hamstring autograft diameter was 8 mm (37%). Four patients had a graft diameter of 6 mm (Figure 13). Figure 14 shows the graft diameters among men and women in different age groups. We studied the correlation between the patients' BMI and their graft diameter utilizing correlation coefficients (Pearson r). Figure 15 demonstrates that the hamstring graft diameter was proportionately related to BMI ($r = 0.25$, $P = 0.013$). This suggests that patients with higher BMI will have a bigger graft diameter.

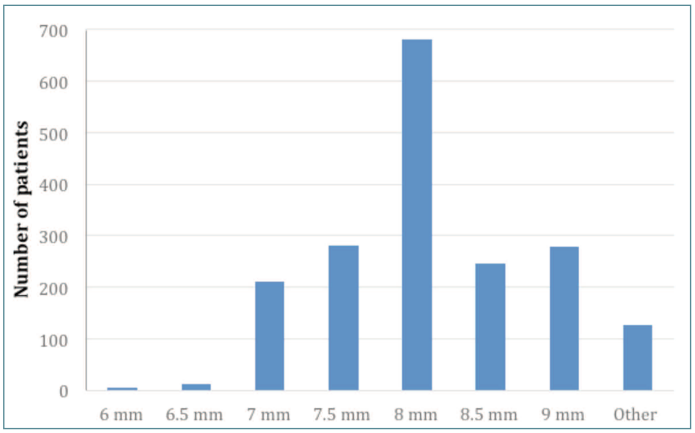

Figure 13: Graft diameter. Data from a total of 1838 patients were available for analysis.

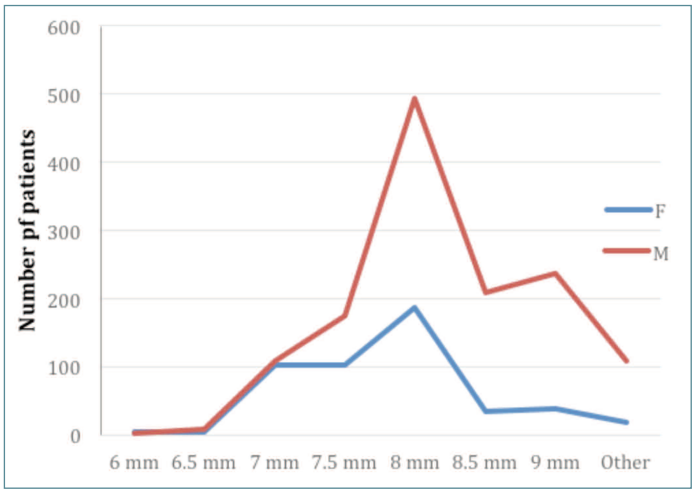

Figure 14: Graft diameter among men and women in different age groups

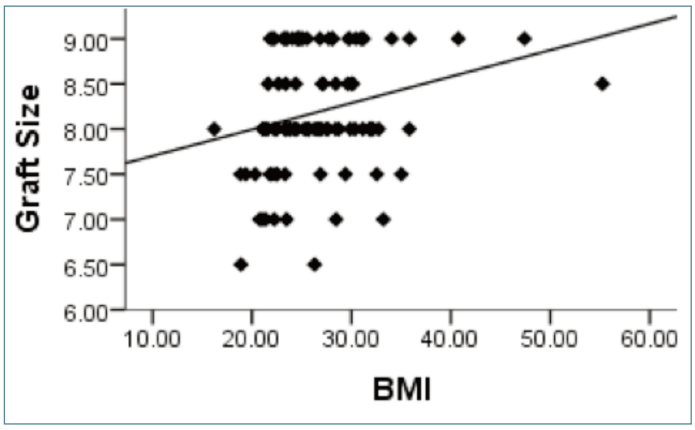

Figure 15: Correlation between BMI and graft diameter

4.12 Femoral and tibial tunnels drilling:

Anteromedial portal (AM) was the most common portal for femoral tunnel drilling (Figure 16). The second common portal was the transtibial portal. The ouside-in technique was the predominant technique for tibial tunnel drilling(Figure 17). We further analyzed the technique for femoral and tibial tunnels drilling against the volume of procedures performed by each surgeon (Figure 18). Low volume surgeon was defined as a surgeon performing ten or less ACLR procedures per year. A high volume surgeon was defined as a surgeon performing more than ten ACLR procedures per year. For femoral tunnel drilling, high volume surgeons tend to use AM portal and all inside technique more than low volume surgeons. Low volume surgeons seem to be less familiar with all-inside technique for tibial tunnel drilling compared to high volume surgeons.

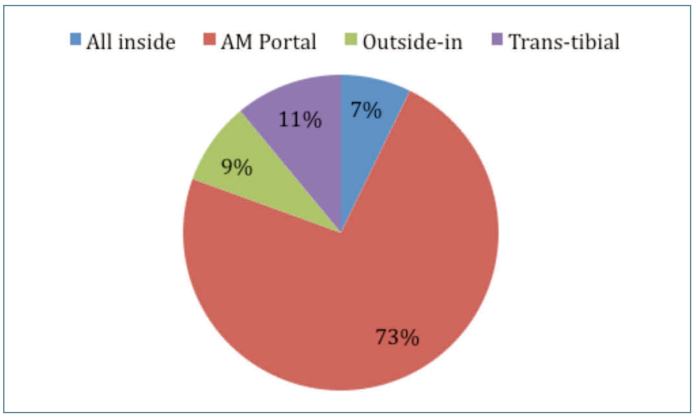

Figure 16: Femoral Tunnel Drilling Techniques

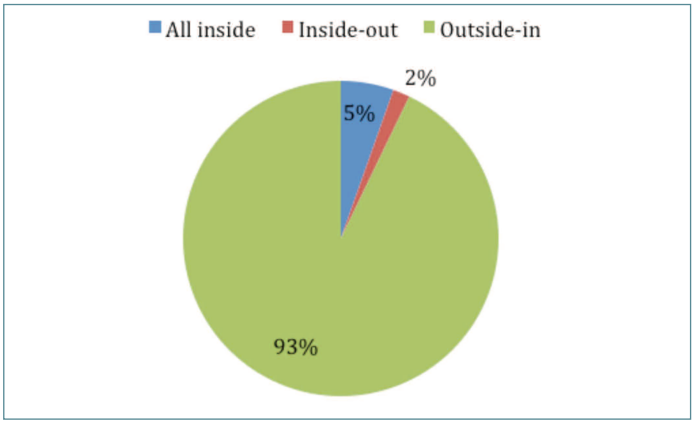

Figure 17: Tibial Tunnel Drilling Techniques

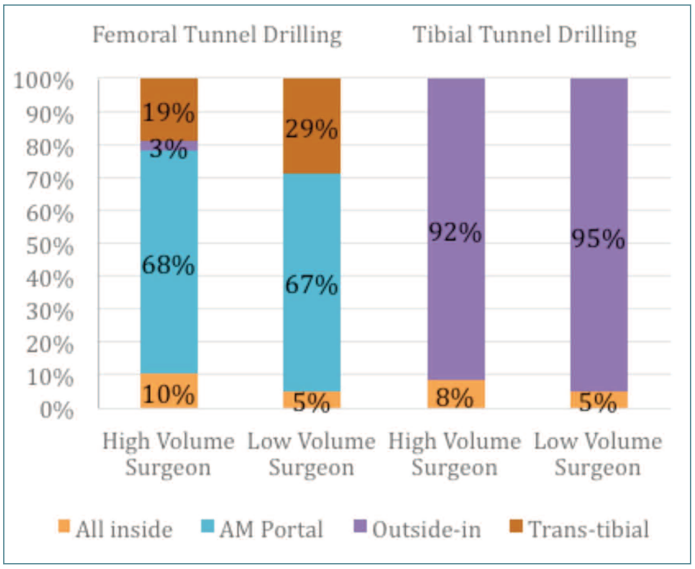

Figure 18: High and low volume surgeons preferences for femoral and tibial tunnel drilling.

4.13 Femoral and tibial tunnels fixation

Figure (19) shows the percentage of different fixation devices for the ACL graft in the femoral tunnel. Endobutton suspensory mechanism was the most common fixation method (71%) followed by interference screws (22%). For tibial tunnel fixation, interference screws were used in 87% of ACLR procedures (Figure 20). Details of different devices used for femoral and tibial tunnel fixation are provided in Appendix A.

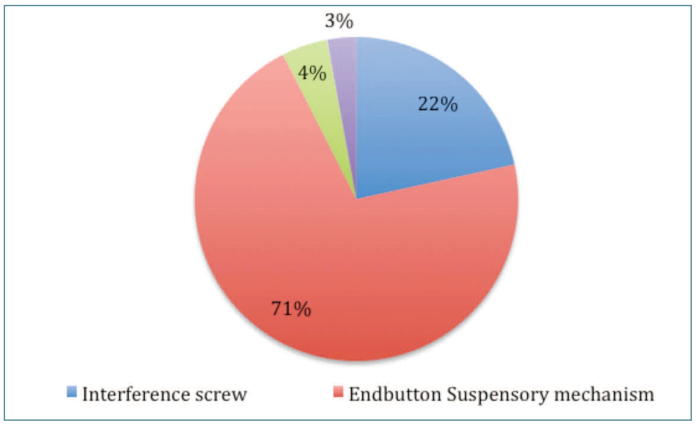

Figure 19: Femoral fixation devices

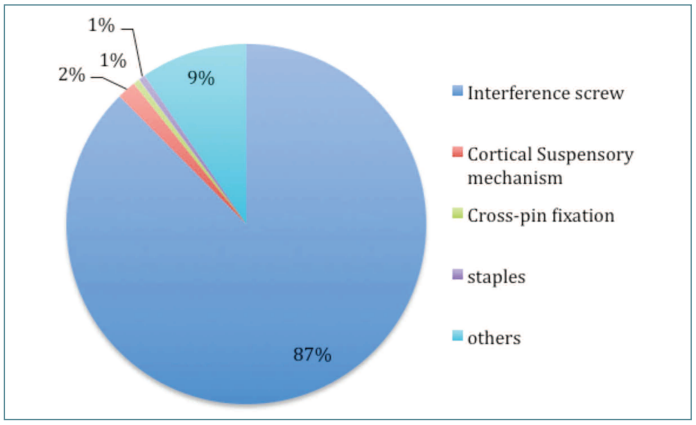

Figure 20: Tibial tunnel fixation devices

4.14 Patient reported outcome measures (PROMS)

PROMs have become an integral part for assessment of any surgical intervention. A combination of generic and disease specific outcome measure is commonly used to assess the treatment outcome. The NLR collect PROMS from patients preoperatively and at 6 months, 1 year, 2 years and 5 years postoperative ACLR surgery. The collected PROMs are EQ-5D, IKDC subjective, Tegner and KOOS scores.

4.15 EQ-5D

The EQ-5D is a simple generic measure of health for clinical and economic appraisal. It allows description of general health status along five domains. The results are presented as an index, a quality of life weighting between 0 (death) and 1 (complete health). The EQ VAS records the respondent's self-rated health on a 0 to 100 visual analogue scale with endpoints labelled 'the best health you can imagine' and 'the worst health you can imagine'. Figure 21 and figure 22 show improvement in postoperative EQ5D-index and EQ5D-VAS scores at 6 months and 1 year compared to preoperative scores.

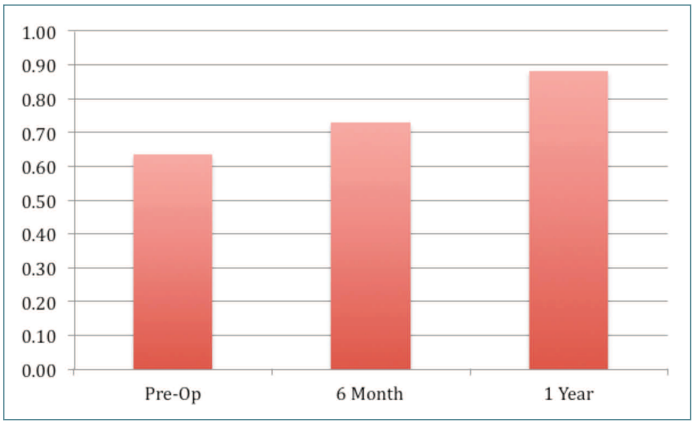

Figure 21: The average preoperative, 6 months and 1 year postoperative EQ5D-index scores for ACLR procedures.

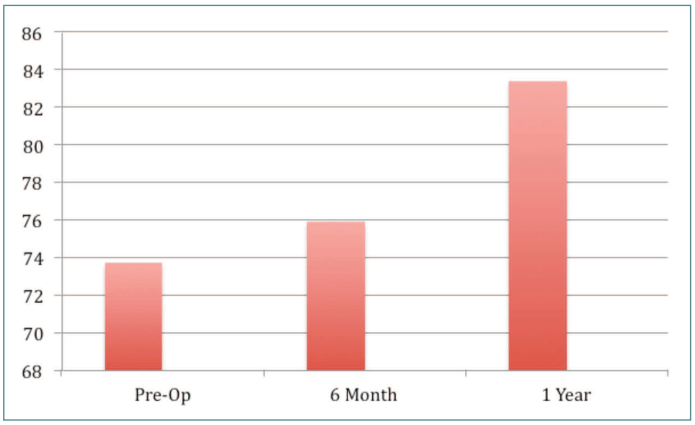

Figure 22: The average preoperative, 6 months and 1 year postoperative EQ5D-VAS scores ACLR procedures.

4.16 The International Knee Documentation Committee (IKDC)

The IKDC subjective knee questionnaire consists of 18 questions and evaluates symptoms, function, and sports activity. The raw scores are summed and transformed to a scale from 0 to 100. Figure 23 shows improvement in postoperative IKDC subjective scores at 6 months compared to preoperative score. A significant improvement in the average IKDC subjective score is noticed at 1 year postoperatively.

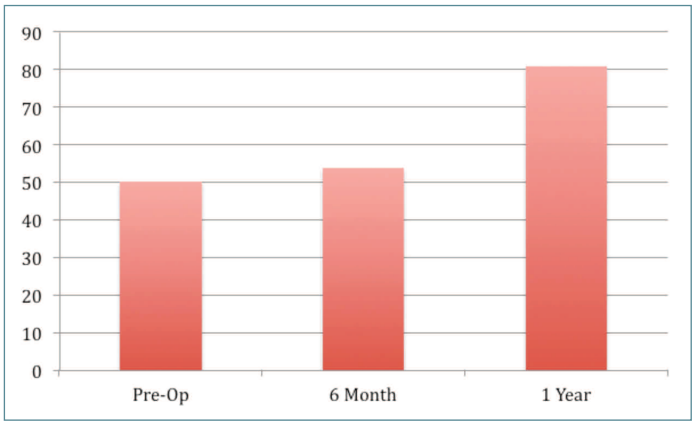

Figure 23: The average preoperative, 6 months and 1 year postoperative IKDC subjective scores for ACLR procedures.

4.17 Tegner score

The Tegner activity scale was designed as a score of activity level for patients with ligamentous injuries. The instrument scores a person's activity level between 0 and 10 where 0 is 'on sick leave/disability' and 10 is 'participation in competitive sports'.

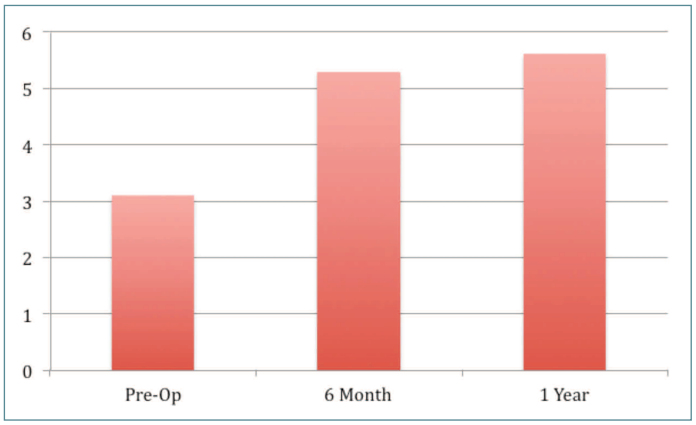

Figure 24: The average preoperative, 6 months and 1 year postoperative Tegner scores for ACLR procedures.

4.18 Knee Injury and Osteoarthritis Outcome Score (KOOS)

The KOOS is a knee-specific patient-reported instrument. It is used to evaluate five domains: pain, symptoms, activity of daily living, sport and recreation, as well as the knee-related quality of life in patients with knee injuries who are at risk of OA developing (ACL, meniscus, or chondral) injury. It consists of 42-item self- administered self-explanatory questionnaire is intended to monitor the short- and long-term consequences (i.e., OA) of these injuries. Figure 25 demonstrates the improvement in the average KOOS scores at 6 months and 1 year postoperatively across the 5 subscales. The quality of life subscale showed the highest increase in scores postoperative and was the most sensitive to change in the patient general health. Figures 26 to 30 show the KOOS 5 subscales in different age groups. It is interesting to note that there was a significant improvement in all KOOS subscales with increasing age. The greatest improvement was in the patients between the age 40 and 50 years old especially in the quality of life subscale at one year postoperatively.

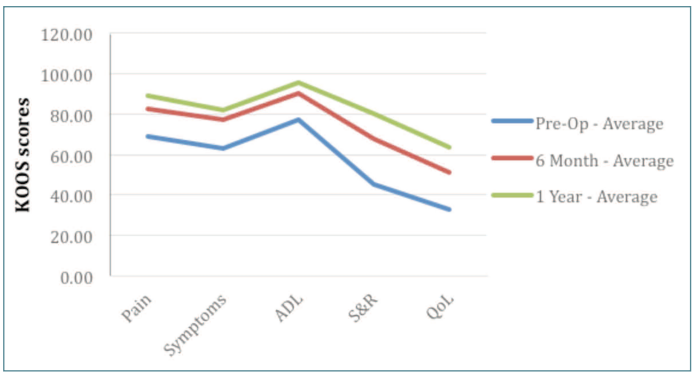

Figure 25: The average preoperative, 6 months and 1 year postoperative KOOS scores for ACLR procedures.

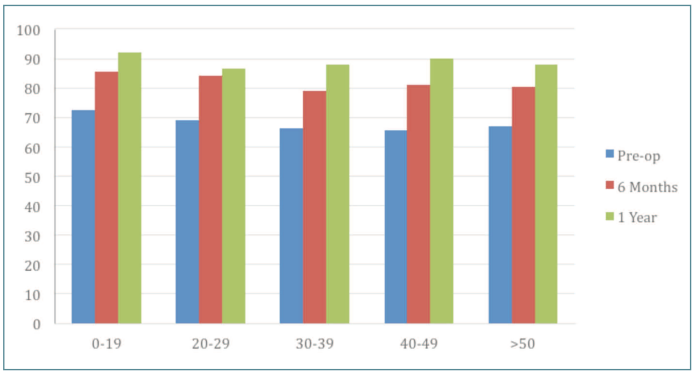

Figure 26: The average preoperative, 6 months and 1 year postoperative KOOS (pain) scores for ACLR procedures in different age groups.

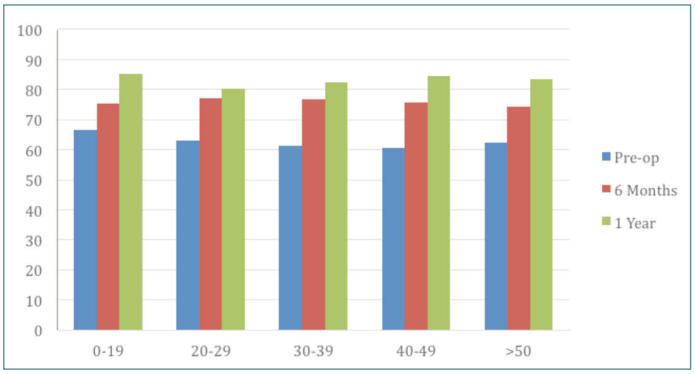

Figure 27: The average preoperative, 6 months and 1 year postoperative KOOS (Symptoms) scores for ACLR procedures in different age groups.

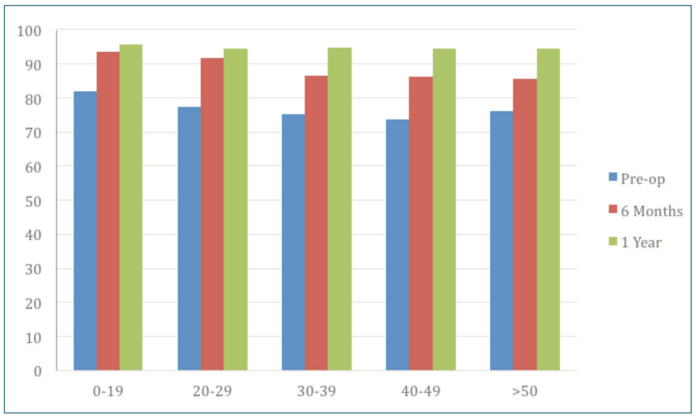

Figure 28: The average preoperative, 6 months and 1 year postoperative KOOS (ADL) scores for ACLR procedures in different age groups.

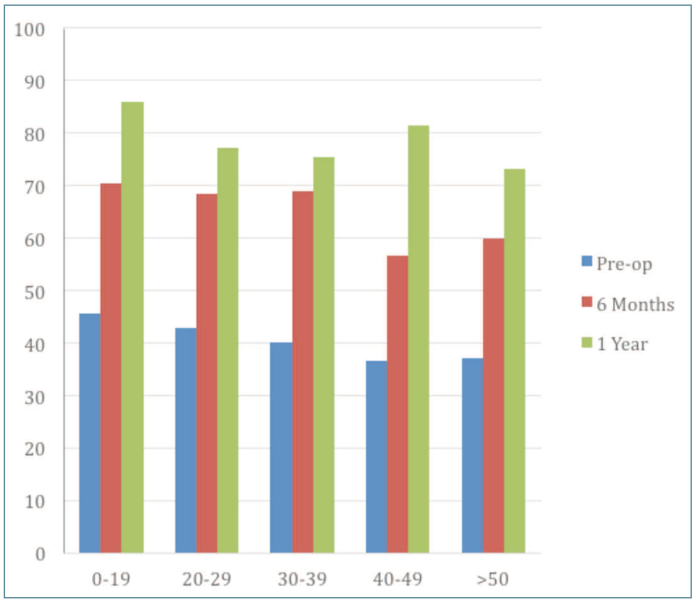

Figure 29: The average preoperative, 6 months and 1 year postoperative KOOS (sports and recreation) scores for ACLR procedures in different age groups.

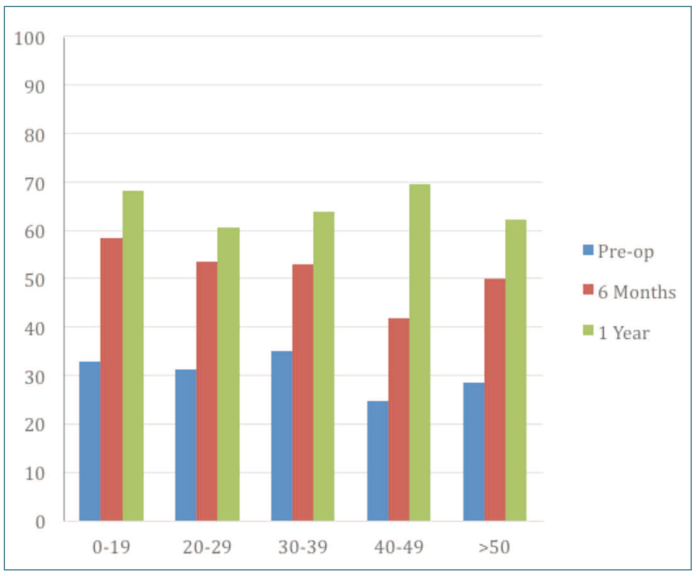

Figure 30: The average preoperative, 6 months and 1 year postoperative KOOS (Quality of Life) scores for ACLR procedures in different age groups.

4.19 Complications

There was only a record of two complications entered on the NLR online database. Both cases were superficial wound infection. No other complications, including revision surgery, were recorded on the database.

4.20 Compliance

The NLR is web-based register that relies on data entered by patients as well as surgeons. Figure 31 demonstrates the compliance rate for filling in the basic information entered for each patient. Email address is a fundamental step in registering patients on the NLR as it the main contact tool with the patient. Around 89% of patients have their email address entered on the NLR database.

Figure 32 shows compliance with filling in the different preoperative and postoperative PROMS questionnaires. The response rate preoperatively is over 50%. However, this drops down to around 17% at 1 year postoperatively.

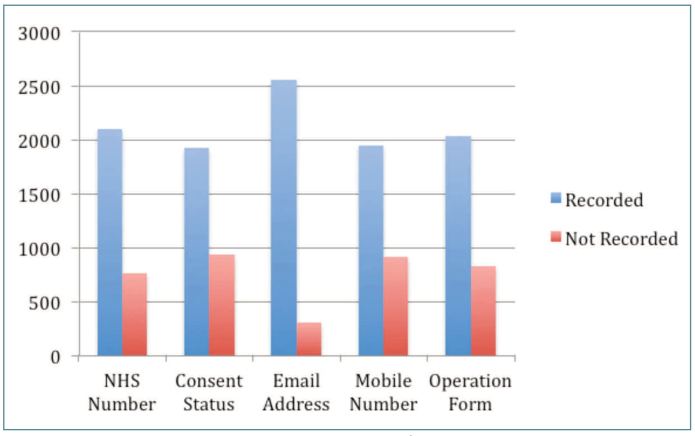

Figure 31: Compliance with basic patients information

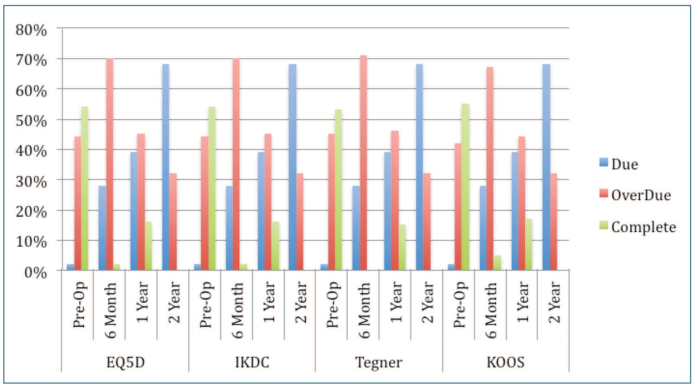

Figure 32: Response rate for different preoperative and postoperative PROMs

5 Summary

Over the last 2 years, The NLR has provided invaluable information on the epidemiology, operative techniques and functional outcomes for patients with ACL injuries. Plenty of observations could be drawn from the data provided in this report. We had a total of 2854 ACLR patients between December 2012 and February 2015. Men in the age of 20s were the predominant group of patients who underwent ACLR surgery. Sports injuries and specifically football was the most common cause for ACL injury. Medial meniscus surgery was the most common associated procedure with ACLR surgery. Allograft was used in only 1% of patients who had ACLR procedures. Four-strands hamstring tendon was the most frequently used autograft. AM portal drilling was the most common technique for femoral tunnel drilling while it was the outside-in technique for the tibial tunnel drilling. The Endobutton suspensory mechanism was the most common method for graft fixation in the femoral tunnel while interference screws predominated for tibial tunnel fixation. Patients who underwent ACLR surgery showed steady progress of their functional outcome score at six month and 1 year postoperatively compared to their preoperative scores.

6 Future plans

The overall goal of the NLR is to promote the improved care of individuals with ACL injuries. The results outlined in this report resemble the beginning of what we want to achieve as a long-term goal. We have outlined below our plans for improving the NLR in the forthcoming year.

a. Increase data capture

Increase number of registered consultants - The intention of this registry is to develop a safe and user-friendly system to record the extent and outcomes of knee ligament surgery in the UK. We remain a surgeon led Registry and endeavour to maintain this position in the future. This remains a 'development' area and we are aware that there are several reasons for surgeons not utilising the NLR. Smart phone and tablet apps can be developed to improve data collection by the clinical team. This enhances not only the ease of data input but creates a more systematic approach and could allow information to be inputted at the time of surgery or clinical review, reducing error and increasing registry compliance. We are currently making moves towards mandating the use of the registry in both NHS and private sectors and are considering the potential benefits of becoming an accredited 'National clinical audit' with HQIP.

Improve data capture - The population undergoing ACL reconstructions are typically young, very mobile and busy. This makes them difficult to trace and track which is why two of the key elements of information are the NHS number and an email address. This is the electronic age and email and text communication is the norm and must be acknowledged. It will take some effort and vigilance to enter patients but with automated follow up the process is simple and appealing. Apps could also be developed for patient data collection – allowing subjects to collect their own data at home (e.g. video capture and sensor data). While these are likely to be more subjective they would provide invaluable insight to the patient experience opening up a whole new avenue of research work on this scale.

Demographic data - Further analysis of the patients' profile including ethnicity and social area deprivation will be conducted. The UK has the advantage of multi-ethnicity among its population, which will help better understanding for the epidemiology of ACL injuries. As an example, there is very little known about ACL injuries in the peripartum period. It would be interesting to collect data on the incidence and functional outcome for subject who had ACL injuries during the peripartum period.

Increase information gathered/Include revision ACL surgery - To date, we have concentrated on a single procedure, primary ACLR, and we are confident that the results will benefit future surgeons and patients alike. When established it will ease the journey to develop similar pathways for the revision of ACL procedures, non-operative treatment of ACL rupture and other ligament reconstructions.

Post – operative data - We are working to involve our physical therapists in this work to a greater degree and are planning, in connection with the evolution of our IT platforms, to improve our website when it comes to follow-ups after surgery and rehabilitation. Granting access to physiotherapists to input data online during rehabilitation will enrich our register with objective assessments for ACLR patients during rehabilitation period. Objective measures such as Lachman test and KT-1000 could be recorded online by the physiotherapists on follow up assessment.

b. Improved data analysis

Data analysis is the end point against which the NLR will be judged. Currently data is analysed using simple correlations and basic statistical analysis. The world of data analysis is changing rapidly – especially with new fully validated machine learning tools – the NLR must look to these methods to truly uncover the impact of the data being collected.

c. Improve Consultant Gains

Clinicians now have a framework to collect outcome data regarding their own ACLR practice, benchmarking it against practice across the NHS. The data can also be a valuable contribution towards each surgeon's annual appraisal and revalidation.

d. Build on other European ligament registry experience

We are enormously indebted and grateful to our forerunners the Scandinavian Registries. They were established in 2005 and have produced several annual reports to date. We must learn from some of their experiences, cost and follow up rate in particular, and hopefully develop an improved and reproducible model.

The scope of the ligament registry is vast and complete data capture is a lofty ambition. If we use the incidence figures quoted in the Swedish ACL Registry and assume a UK population of 60 million then we expect approximately 60,000 ACL ruptures a year. The Swedish Registry expects about 50% to require/undergo reconstruction that will be 30,000 patients a year in the UK. This is a great platform for the researchers and clinicians treating ACL injuries.

Appendices

Appendix A: Femoral and tibial tunnels fixation devices

Table 4: Femoral tunnel fixation devices

Arthrex Bio-Interferance	2
Arthrex Cannulated Full Thread Interference Screw	1
Arthrex RetroButton	75
Arthrex TightRope	159
Arthrex Transfix	11
DePuy Mitek Intrafix ACL Fixation	1
DePuy Mitek Rigidfix	64
LARS Interference Screw	1
Linvatec BioScrew	14
Linvatec ExoButton	12
Other	49
Smith and Nephew BIORCI RT	4
Smith and Nephew BIORCI-HA SCREW	6
Smith and Nephew Calaxo	1
Smith and Nephew Endobutton	917
Smith and Nephew RCI	145
Smith and Nephew RCI RT	93
Smith and Nephew Soft Silk	44
Stortz MegaFix	43
Smith and Nephew BioSure HA screw	3
Biomet ToggleLoc with Ziploop	16
Biomet EZLoc	15
Linvatec Matryx Femoral screw	4
Smith and Nephew BIORCI	2
Arthrex BTB Tight-Rope	4
Arthrex Medical Portal TransFix	2

Table 5: Tibial Tunnel fixation devices

Arthrex GraftBolt	11
Arthrex FlipCutter	3
Arthrex Medical Portal TransFix	1
Arthrex Soft Screw	9
Arthrex TightRope	93
ArthrexTransfix	9
DePuy Mitek Bio-Intrafix ACL Fixation	136
DePuy Mitek Milagro Biocryl Rapide	9
LARS Interference Screw	1
Linvatec Bioscrew	8
Linvatec Bioscrew XtraLok	98
Linvatec XtraLok Screw	71
Other	85
Other Screw	83
Screw/Washer	1
Smith and Nephew BIORCI HA screw	75
Smith and Nephew BioSure HA screw	216
Smith and Nephew RCI	625
Smith and Nephew RCI RT	19
Smith and Nephew Soft Sil	39
Staples	5
Stortz MegaFix	69
Sutures and Post	6
Biomet WasherLoc	15
Arthrex BTB Tight-Rope	1
DePuy Mitek Milagro	27
Biomet TunneLoc	7
Arthrex Titanium SoftScrew	1

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