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PO Box 6398
Dunedin
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Tel: +64-3-477-7887
Fax: +64-3-477-7882
Email: smnznat@xtra.co.nz
Web: www.sportsmedicine.co.nz

EDITOR
Dr Chris Milne

INFORMATION FOR AUTHORS
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The Editor
NZ Journal of Sports Medicine
Sports Medicine New Zealand
PO Box 6398
Dunedin
NEW ZEALAND
Email: smnznat@xtra.co.nz

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Contents

A new broom ...

In November of 2008 I was asked to take over the editorship of the journal. It is an important time in the history of the journal as we make the transition from print to electronic form.

I would like to pay tribute to my predecessors in this role – firstly, Noel Roydhouse, the founding editor who put the journal together on the smell of an oily rag for about 20 years. I recall as a secondary school student seeing old copies of the journal at the Tokoroa Track Club where I grew up as a child. I am not sure that many running clubs still subscribe to sports medicine journals, however. Secondly, Dale Speedy, who carried on Noel's good work for several years before handing over to Peter Milburn, who has now headed off to a new academic post in Australia but generously passed on some useful tips to me.

Any editor stamps their own mark on a publication. For my part, I intend introducing several new features. Firstly, a column called "Then and Now", that will make its debut later this year. Secondly, I believe it is important to try and increase the contribution from senior clinicians. My aim is to try and co-ordinate this via key representatives from each of the disciplines. The plan would be to provide practical up to date summaries of topical issues. Thirdly, experienced clinicians accumulate many pearls of wisdom during their time in the field. A lot of these pearls have been handed down from their mentors. Once again, I would like to get our experienced clinicians to pass these pearls on for the benefit of the readership. The best clinical pearl submitted each year will qualify for the 'Editor's Choice' Award at our Annual Conference. Finally, as clinicians we face difficult ethical decisions from time to time. There is often no easy answer to such issues, but I believe this journal could serve as a forum for discussion of some of them.

Another important initiative is collaboration with our teaching institutions. We are in the process of setting up a partnership with Auckland University and their sports medicine teaching unit based at the School of Population Health. Further information will be provided as this partnership develops.

Don't forget, this is your journal. Its contents should reflect the needs of local clinicians whilst maintaining some interest for those beyond our shores. If you've got this far you're already interested enough in the fate of the journal for your opinion to mean something, so don't hesitate to contact Brenda Allum at the National Office with any ideas. Likewise, any clinical pearls or other experience that you have to share that would be of benefit to our readers. With input from the sports medicine community we seek to serve, the journal should have a vital role to play as the conduit for good ideas and discussion.

Dr Chris Milne
Editor

BEST OF BRITISH

July

The July 2008 issue contained a couple of thought-provoking articles by well-known South African researcher Tim Noakes. In the first of these, he states that the practice of testing for maximal oxygen consumption, where fatigue results from a failure to maintain homeostasis either in the active muscles (peripheral fatigue) or in the CNS (central fatigue) is fundamentally flawed. Rather, he contends that competing athletes (and indeed all exercising human beings) use an antipatory (central governor) technique. By this means, the central motor command determines the initial pace by recruiting the appropriate number of motor units in the exercising muscles. Feedback during exercise then modifies the pace through the event. This is a highly provocative article, which should raise the hackles of exercise physiologists, but surprisingly does not seem to have done so. Later in the same issue, he explains that there is still no clarity regarding VO_2max and the 'plateau phenomenon'. The majority of exercise tests end in the absence of a plateau being reached. Another thought-provoking piece.

Also in the July issue is an article by a US based group on joint loading modaties (eg, vibration) to enhance fracture healing. These authors found that these modalities are effective, possibly because of alterations in pressure or fluid flow in the cortex of fractured bone.

August

In the August issue, there was an excellent article from a Belgian group detailing a clinical reasoning algorithm for impingement-related shoulder pain. Via a series of clinical tests including Jobe, Neer, Hawkins impingement tests for instability and labral tests, shoulder problems can be relatively well pigeon-holed. A particular strength is a picture of each test demonstrating how they should be performed. Worth a look if you are getting rusty on this topic, or want some reassurance you are doing things correctly! In the editorial for August, Karim Khan makes the point that manual therapy is highly effective for neck and back pain. For the few remaining unbelievers, he quotes findings from the 9th International Congress of the International Federation of Orthopaedic Manual Therapists. A systematic review found that the NNT (number needed to treat) was only five. This is very impressive, compared with use of osteoporosis drugs to prevent hip fractures, where the NNT is 500 (ie, 500 65 year old patients would need to be treated to prevent one hip fracture per year).

September

In the September issue, there was a detailed analysis of medication and nutritional supplement use by football players in the FIFA World Cup in 2002 and 2006. On average these players took 1.8 substances before each game. The most commonly used medications were NSAIDs with more than 10% of players taking these prior to every game. By contrast, asthma inhalers were used by about 1.5% of players during the tournament. This is rather lower than one might have expected - maybe asthma is being under-diagnosed and treated in this group of athletes. There was also a leading article by Professor Roy Shepherd arguing against mass ECG screening of young athletes. As he says, such screening is expensive and because false positive results generate the need for further tests, there is a decrease in quality-adjusted life years for the community.

Later in the same issue was an article on eccentric calf muscle training for chronic insertional Achilles tendinopathy. Co-authored by Professor Haken Alfredson, a previous keynote speaker at SMNZ's Annual Conference, it showed promising clinical results in 67% of patients. This is promising, as insertional Achilles tendinopathy has hitherto been very resistant to treatment.

October

The October issue of BJSM had several useful articles. One of the most useful was by Gregory et al entitled What to Tell the Media. It provides useful guidelines for clinicians who work with high profile teams where there is significant media interest.The guidelines are based on the General Medical Council publication Good Medical Practice published in the UK in 2005. From my own perspective, I would say that whenever there is important information that needs to be conveyed about a player's health or injury concerns, the best thing is to have a discussion with that player and agree on what will be said. In my experience, it is better to release a small amount of information that the player has agreed to rather than to stonewall the media, which can often lead to further problems.

The second article of interest in this issue is an update on patellofemoral pain by Fagan and Delahunt. They conducted a literature review over the last decade and found that there were no randomised controlled trials to support hip strengthening exercises. They did find that physiotherapy treatment appeared to be helpful for addressing quadriceps muscle imbalances, presumably between the VMO and other quadriceps muscles. Finally, they found that both open and closed kinetic chain exercises were helpful.

In the same issue there was a useful article about the trunk muscles of cricketers. They found that on MRI scanning, the quadratus lumborum and erector spinae muscles were larger on the dominant side in cricketers. The imbalance was most marked in fast bowlers with low back pain. This could have implications with regard to conditioning and treatment of such athletes.

November

In the November issue there was a useful article by Warden and Fuchs regarding exercise pills. Clearly, there is a large sector of society that will do anything to avoid exercise whilst trying to reap the benefits it may bring. It is for this large cohort of people that "exercise pills" are being developed and once there is a product with even a hint of efficacy you can be sure that it will be marketed to the max. With the latest guidelines on exercise intensity that have been circulating for the past decade recommending habitual moderate activity, it would seem to me that this is preferable to sitting inside and taking a pill and remaining a couch potato. The jury is still out on the matter.

Also in the same issue was an excellent article by Jill Cook regarding application of study findings to clinical practice. She notes that there was a lot of money spent on isokinetic machines in the 1980s based on research in the 1970s, and now there is an equally large sum of money being spent on Pilates machines. Claims for effectiveness of various machines have been touted well beyond what the research has shown. This is a common theme and one which we clinicians need to be on our guard against. A fair dose of cynicism is a healthy thing.

The December issue featured a useful debate on the place of glucocorticosteroids in the banned drugs list. John Orchard, who has spoken at previous NZSFM conferences, has written eloquently on why these drugs should be removed. The contrary view is put by Montalvan and Duclos. I must confess that I found John Orchard's arguments the more compelling. It is worth a read for all of us who are treating athletes subject to drug testing, especially as glucocorticoids are essential drugs in the treatment of acute exacerbations of asthma, inflammatory bowel disease and inflammatory arthritis.

Also in the same issue was an excellent article by Frank Booth entitled Linking Performance and Chronic Disease Risk: Indices of physical performance are surrogates for health. These authors argue that the research on elite athlete and chronic disease prevention by exercise is actually addressing the same phenomena. I guess the take home message is if you want to remain healthy then keep pushing your body well into middle and older age.

December

Finally in the December issue, there was a systematic literature review on sports hernias. The authors state that these occur more often in men, which is no surprise when one understands the developmental processes in the male where the testes drop down from the abdominal cavity into the scrotum. They state that the likely causative factor is posterior inguinal wall weakening from excessive or high repetition shear forces applied through the pelvic attachments of poorly balanced hip adductor and abdominal muscle activation. They explain that there is no consensus as to what specifically constitutes the diagnosis, and therefore imaging such as MRI and ultrasound scans are frequently used primarily to exclude other conditions. They state that surgery seems to be more effective than conservative treatments and laparoscopic techniques are associated with a quicker recovery time. However, like all researchers, they conclude by saying that further research is required.

It is hard to pick a most valuable article from this collection. As a practising clinician who has had to deal a fair bit with media issues in my lifetime, I would plump for Gregory's article on what to tell the media. However, the article by Booth on physical performance as a surrogate measure of health has probably got significantly more impact for the wider population.

Chris Milne
Sports Physician
Hamilton

Injuries in the New Zealand semi-professional rugby league competition

D A King MHealSc[1], **T J Gabbett** PhD[2]

1 Emergency Department
Hutt Valley District Health Board
Lower Hutt
NEW ZEALAND

2 Brisbane Broncos Rugby League Club
Red Hill
Queensland
AUSTRALIA

Correspondence to:
Doug King
Emergency Department
Hutt Valley District Health Board
Private Bag
Lower Hutt
NEW ZEALAND
Tel: +64 4 566 6999 ext 8118
Email: douglas.king@huttvalleydhb.org.nz

ABSTRACT

Objective: **While the incidence of rugby league injuries has been investigated, the majority of studies have been limited to single clubs. The purpose of this study was to document and identify injuries sustained in the 2005 New Zealand semi-professional rugby league competition, the Bartercard Cup.**

Methods: **Eight teams competing in the 2005 Bartercard Cup competition were studied using a prospective observational field based study. All injuries sustained in the competition were recorded on a standardized injury reporting form. Injuries were categorized according to type, site, cause and severity of the injury. Injuries were recorded as rate per 1000 playing hours and were classified by severity according to the number of matches missed.**

Results: **The overall incidence of injury for the competition was 115 per 1000 playing hours while the incidence of injuries resulting in missed matches was 78 per 1000 playing hours. Forty-seven percent (54 per 1000 playing hours) of all injuries sustained occurred in the lower limbs. Most injuries occurred in the tackle situation (95 per 1000 playing hours). The shoulder was the single most common injury site (16 per 1000 playing hours). Strains were the most common injury type (28 per 1000 playing hours).**

Conclusion: **The results of this study demonstrate that the incidence of injury in New Zealand semi-professional rugby league players is similar to that previously reported in Australian semi-professional rugby league players. Further research investigating risk factors for tackling injuries is warranted in an attempt to reduce the incidence of ball carrier and tackler injuries in rugby league.**

Keywords: **injury incidence, semi-professional, rugby league**

INTRODUCTION

Rugby league is an international collision sport played by junior, amateur, semi-professional and professional players.[1-4] The game requires participants to be involved in physically demanding activities such as running, tackling, passing and sprinting.[5,6] These activities are often interspersed with short bouts of low intensity activity such as jogging and walking.[5, 6] Exposure to physical collisions and tackles is common in rugby league and musculoskeletal injuries occur as a consequence of participation in the sport.[5,7,8]

There have been several studies of the incidence of injury in rugby league in amateur[1,9-11] and professional[12-14] levels of participation, but only one in semi-professional[5] participation. Professional rugby league has reported a 1.3 to 2.2 fold higher injury incidence than amateur participation.[5] The study on semi-professional participation reported a higher injury incidence than either amateur or professional participation injury rates.[5] To date, few studies have investigated the incidence of injury in New Zealand rugby league players.[10, 11] These studies have reported injury rates in the range of 24.5[11] to 278[10] per 1000 playing hours, depending on the injury definition used. However these studies are dated with no recent studies completed in New Zealand rugby league matches.

The Bartercard Cup was introduced in 2000 and is New Zealand's semi-professional competition. The competition consists of 12 teams from throughout New Zealand. The competition has resulted in several players being promoted towards the professional level and has proven successful for rugby league in the country. The purpose of this study was to investigate the incidence, site, nature, cause,and severity of injuries sustained during match participation in the 2005 New Zealand Bartercard Cup competition.

METHODS

A prospective observational field based study was undertaken to document the incidence of injuries in matches occurring over the 2005 New Zealand rugby league Bartercard Cup competition. This involved data collection on 240 rugby league players from eight of the 12 competing teams. All teams were invited to participate in the study and eight teams agreed and consented to data being collected. Ethical approval was obtained from the University of Otago Ethics Committee. Team trainers recorded all injuries on a standardized injury reporting form regardless of severity (see Figure 1). The injury reporting form was modified to meet the requirements of the study but utilized the format previously established in studies on rugby league injuries.[5,15]

The participating teams competed in a home and away competition format. All player matches were played over 80 minutes duration (40 minutes per half) and under the limited 12 person interchange rule. Three of the participating teams were eligible for the final series with one participating team going through to the grand final match. The competing teams had their own trainers that were allowed access to the field of play. All team trainers were nationally accredited in injury prevention, assessment and management through the New Zealand Rugby League Academy of Excellence. Each of the participating team trainers recorded their own injury data on a standardized injury reporting form (see Figure 1)[2, 5, 16, 17] and this was entered into a central database.

Definition of Injury

The definition of injury utilized for this study was "*any pain or disability suffered by a player during a match that required advice and/or treatment*".[2-4,9,17,18] Injuries were classified anatomically according to the player position at the time of the injury occurring, the injury site,[4,16,17] the nature of the injury,[4,16,17] and the causative mechanism.[4,5,17] All injuries reported to have occurred during the matches were recorded regardless of severity. However, injuries were also classified according to the number of matches missed as a result of the injury.[2,5,12,17,19]

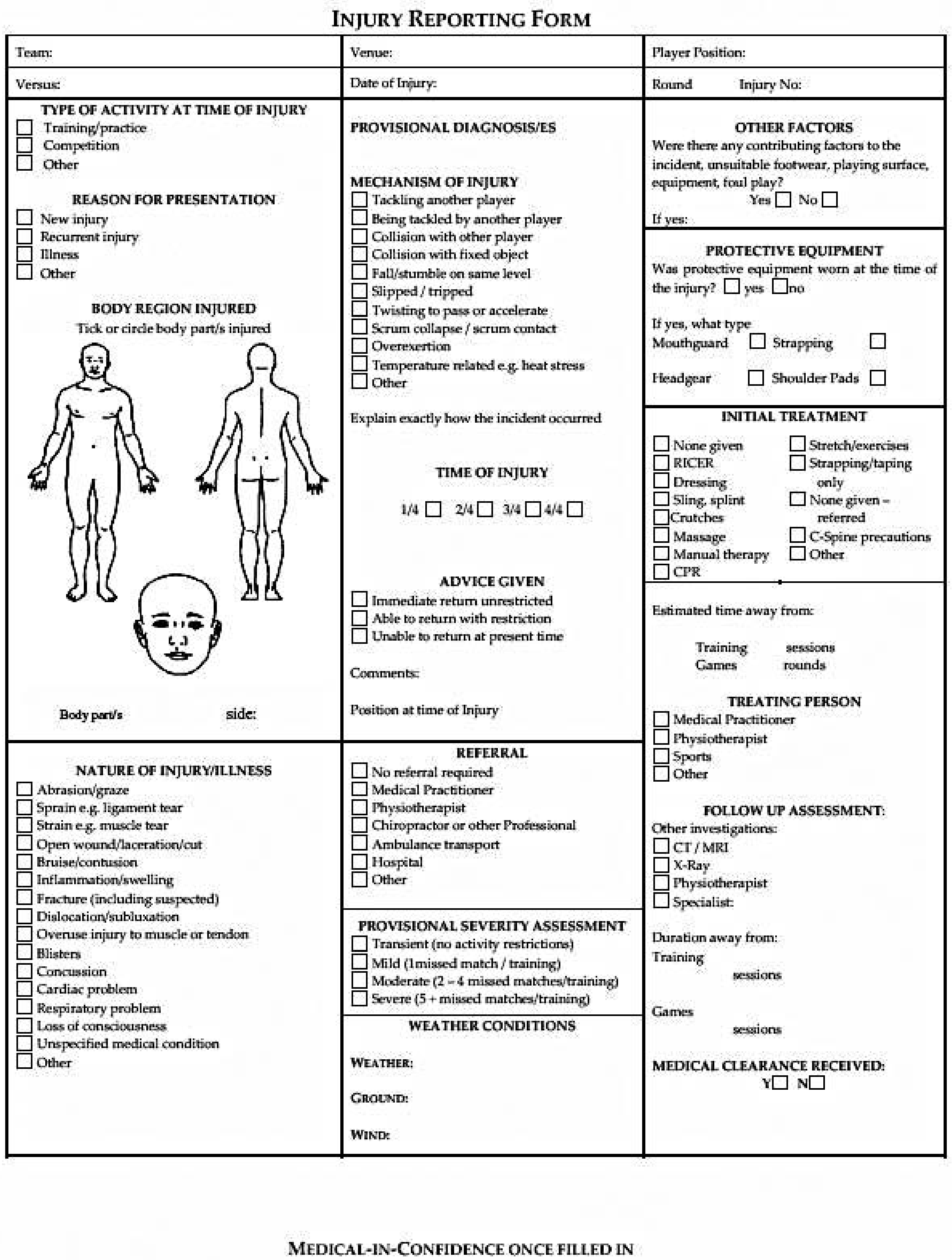
Statistical Analysis

Over the duration of the competition, 136 matches were studied. All matches were 80 minutes (1.33 hours) in duration with an overall injury exposure of 2351 playing hours. The expected injury frequency was calculated as described by Hodgson-Phillips et al.[12] (see Table 1). A one sample chi-squared (X^2) test was used to determine whether the observed injury frequency was significantly different from the expected injury frequency. Data are reported as means and 95% confidence intervals (CI).[20] Significant p values reported in the text are less than 0.0001 if they are not specifically stated.

TABLE 1: Injury statistics per month for rate, man hours, per game, player appearances and per minutes played.

	April	May	June	July	August	September
No injuries observed	51	40	55	56	59	9
No injuries expected	47.6	47.6	47.6	63.5	59.6	4.0
Injury rates per 1000 h played 95% CI*	122.9 (93.4 - 161.7)	96.4 (70.7 - 131.4)	132.5 (101.8 - 172.6)	101.2 (77.9 - 131.4)	113.7 (88.1 - 146.8)	260.3 (135.4 - 500.2)
Number games played	24	24	24	32	30	2
Exposure hrs	415.0	415.0	415.0	553.3	518.7	34.6
Man hrs per injury (95% CI)	8.1 (7.2 - 9.2)	10.4 (9.2 – 11.7)	7.5(6.7 -8.5)	9.9 (8.8 - 11.1)	8.8(7.8 - 9.9)	3.8(3.4 - 4.3)
Total number injuries per game (95%CI)	2.1 (1.9 - 2.4)	1.7 (1.5 - 1.9)	2.3(2.0 -2.6)	1.8 (1.6 - 2.0)	2.0(1.7 - 2.2)	4.5(4.0 - 5.1)
Player appearances per injury (95% CI)	6.1 (5.4 - 6.9)	7.8 (6.9 - 8.8)	5.7(5.0 -6.4)	7.4 (6.6 - 8.4)	6.6(5.9 - 7.4)	2.9(2.6 - 3.3)
Game minutes played per injury (95% CI)	37.6 (33.4 - 42.4)	48.0 (42.6 – 54.1)	34.9(31.0 -39.3)	45.7 (40.6 - 51.5)	40.7(36.1 - 45.8)	17.8(15.8 - 20.0)

**Confidence Intervals*



INJURY REPORTING FORM

Team:
Venue:
Player Position:
Versus:
Date of Injury:
Round Injury No:

TYPE OF ACTIVITY AT TIME OF INJURY
☐ Training/practice
☐ Competition
☐ Other

REASON FOR PRESENTATION
☐ New injury
☐ Recurrent injury
☐ Illness
☐ Other

BODY REGION INJURED
Tick or circle body part/s injured

Body part/s side:

PROVISIONAL DIAGNOSIS/ES

MECHANISM OF INJURY
☐ Tackling another player
☐ Being tackled by another player
☐ Collision with other player
☐ Collision with fixed object
☐ Fall/stumble on same level
☐ Slipped / tripped
☐ Twisting to pass or accelerate
☐ Scrum collapse / scrum contact
☐ Overexertion
☐ Temperature related e.g. heat stress
☐ Other

Explain exactly how the incident occurred

TIME OF INJURY
1/4 ☐ 2/4 ☐ 3/4 ☐ 4/4 ☐

ADVICE GIVEN
☐ Immediate return unrestricted
☐ Able to return with restriction
☐ Unable to return at present time

Comments:

Position at time of Injury

OTHER FACTORS
Were there any contributing factors to the incident, unsuitable footwear, playing surface, equipment, foul play?
Yes ☐ No ☐
If yes:

PROTECTIVE EQUIPMENT
Was protective equipment worn at the time of the injury? ☐ yes ☐ no
If yes, what type
Mouthguard ☐ Strapping ☐
Headgear ☐ Shoulder Pads ☐

INITIAL TREATMENT
☐ None given ☐ Stretch/exercises
☐ RICER ☐ Strapping/taping only
☐ Dressing
☐ Sling, splint ☐ None given – referred
☐ Crutches
☐ Massage ☐ C-Spine precautions
☐ Manual therapy ☐ Other
☐ CPR

Estimated time away from:
Training sessions
Games rounds

TREATING PERSON
☐ Medical Practitioner
☐ Physiotherapist
☐ Sports
☐ Other

NATURE OF INJURY/ILLNESS
☐ Abrasion/graze
☐ Sprain e.g. ligament tear
☐ Strain e.g. muscle tear
☐ Open wound/laceration/cut
☐ Bruise/contusion
☐ Inflammation/swelling
☐ Fracture (including suspected)
☐ Dislocation/subluxation
☐ Overuse injury to muscle or tendon
☐ Blisters
☐ Concussion
☐ Cardiac problem
☐ Respiratory problem
☐ Loss of consciousness
☐ Unspecified medical condition
☐ Other

REFERRAL
☐ No referral required
☐ Medical Practitioner
☐ Physiotherapist
☐ Chiropractor or other Professional
☐ Ambulance transport
☐ Hospital
☐ Other

PROVISIONAL SEVERITY ASSESSMENT
☐ Transient (no activity restrictions)
☐ Mild (1missed match / training)
☐ Moderate (2 – 4 missed matches/training)
☐ Severe (5 + missed matches/training)

WEATHER CONDITIONS
WEATHER:
GROUND:
WIND:

FOLLOW UP ASSESSMENT:
Other investigations:
☐ CT / MRI
☐ X-Ray
☐ Physiotherapist
☐ Specialist:

Duration away from:
Training sessions
Games sessions

MEDICAL CLEARANCE RECEIVED:
Y☐ N☐

MEDICAL-IN-CONFIDENCE ONCE FILLED IN

RESULTS

Over the period of the study a total of 270 injuries were recorded. The overall injury incidence was 115 per 1000 playing hours. The incidence of injuries that resulted in missed matches was 78 per 1000 playing hours.

Player Position

Player position injury incidences for both overall injuries and injuries causing missed matches are shown in Table 2. The fullback recorded more total injuries (149 per 1000 playing hours) for the competition while props recorded more injuries resulting in missed matches (111 per 1000 playing hours). When comparing the injury incidence between forwards and backs there was no statistical difference observed (X^2=2; df=1; p=0.19).

TABLE 2: Injuries by player position for the 2005 New Zealand Bartercard cup competition.

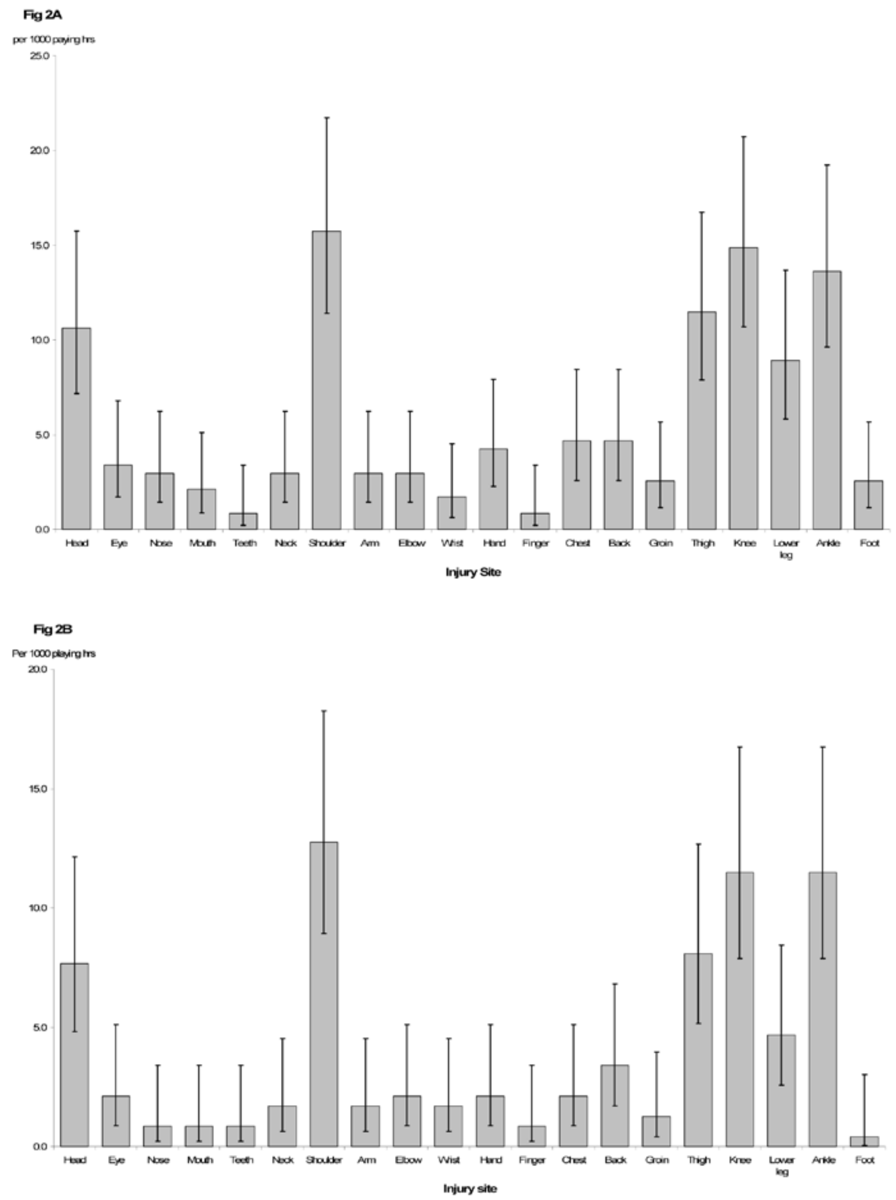
	TOTAL INJURIES				MISSED MATCH INJURIES			
	No	Rate*	95% CI	%	No	Rate*	95% CI	%
Fullback	27	149.3	(102.4 – 217.7)	10.0	18	99.5	(62.7 – 157.9)	8.7
Wing	15	41.5	(25.0 – 68.8)	5.6	11	30.4	(16.8 – 54.9)	5.4
Centre	48	132.7	(100.0 – 176.1)	17.8	35	96.7	(69.5 – 134.8)	14.7
Stand-Off	16	88.5	(54.2 – 144.4)	5.9	9	49.8	(25.9 – 95.6)	4.9
Halfback	18	99.5	(62.7 – 157.9)	6.7	11	60.8	(33.7 – 109.8)	6.0
Prop	50	138.2	(104.8 – 182.4)	18.5	32	88.5	(62.6 – 125.1)	12.5
Hooker	25	138.2	(93.4 – 204.5)	9.3	20	110.6	(71.3 – 171.4)	10.9
Second Row	49	135.4	(102.4 – 179.2)	18.1	33	91.2	(64.9 – 128.3)	15.2
Loose Forward	22	60.8	(40.0 – 92.4)	8.1	15	41.5	(25.0 – 68.8)	8.2

**Rate expressed per 1000 playing hours. CI, confidence intervals.*

Site of Injury

The shoulder was the most common injury site for both total (16 per 1000 playing hours) and missed matches (13 per 1000 playing hours) (see Figure 2). Forty seven percent of the injuries recorded occurred to the lower limbs for both total (54 per 1000 playing hours) and missed match (37 per 1000 playing hours) injuries. The head and neck incurred 20.0% of total (23 per 1000 playing hours) and 17.9% of missed match (14 per 1000 playing hours) injuries.

FIGURE 2: Site of injuries with 95% confidence intervals for overall injuries (A) and injuries resulting in missed matches (B) for the 2005 New Zealand Bartercard Cup competition.



Injury sites differed between forwards and backs for both total and missed match injuries. Forwards recorded significantly more total (22 per 1000 playing hours vs. 10 per 1000 playing hours; X^2=5; df=1; p=0.0224) and missed match (18 per 1000 playing hours vs. 8 per 1000 playing hours; X^2=3; df=1; p=0.242) injures to the shoulder while backs recorded more total (13 per 1000 playing hours vs. 9 per 1000 playing hours; X^2=0.9; df=1; p0.342) and missed match (10 per 1000 playing hours vs. 6 per 1000 playing hours; X^2=0.7; df=1; p=0.4156) injuries to the thigh.

Nature of Injury

The nature of the injuries for total and missed matches is shown in Figure 3. Strains occurred more commonly for both total (28 per 1000 playing hours) and missed match (23 per 1000 playing hours) injuries. Bruises were more commonly reported for forwards than backs (33 per 1000 playing hours vs.21 per 1000 playing hours; X^2=3; df=1; p=0.0801). Fractures (10 per 1000 playing hours vs. 5 per 1000 playing hours; X^2=2; df=1; p=0.1249) and dislocations (10 per 1000 playing hours vs. 6 per 1000 playing hours; X^2=2; df=1; p=0.2030) also featured highly among forwards.

Cause of Injury

Most injuries occurred in the tackle situation (95 per 1000 playing hours) (see Figure 4). There were no statistically significant differences between the ball carrier and the tackling player (51 per 1000 playing hours vs.45 per 1000 playing hours; X^2=0.43, df=1, p=1.0) for the incidence of injuries.

FIGURE 3: Nature of injuries with 95% confidence intervals for overall injuries (A) and injuries resulting in missed matches (B) for the 2005 New Zealand Bartercard Cup competition.

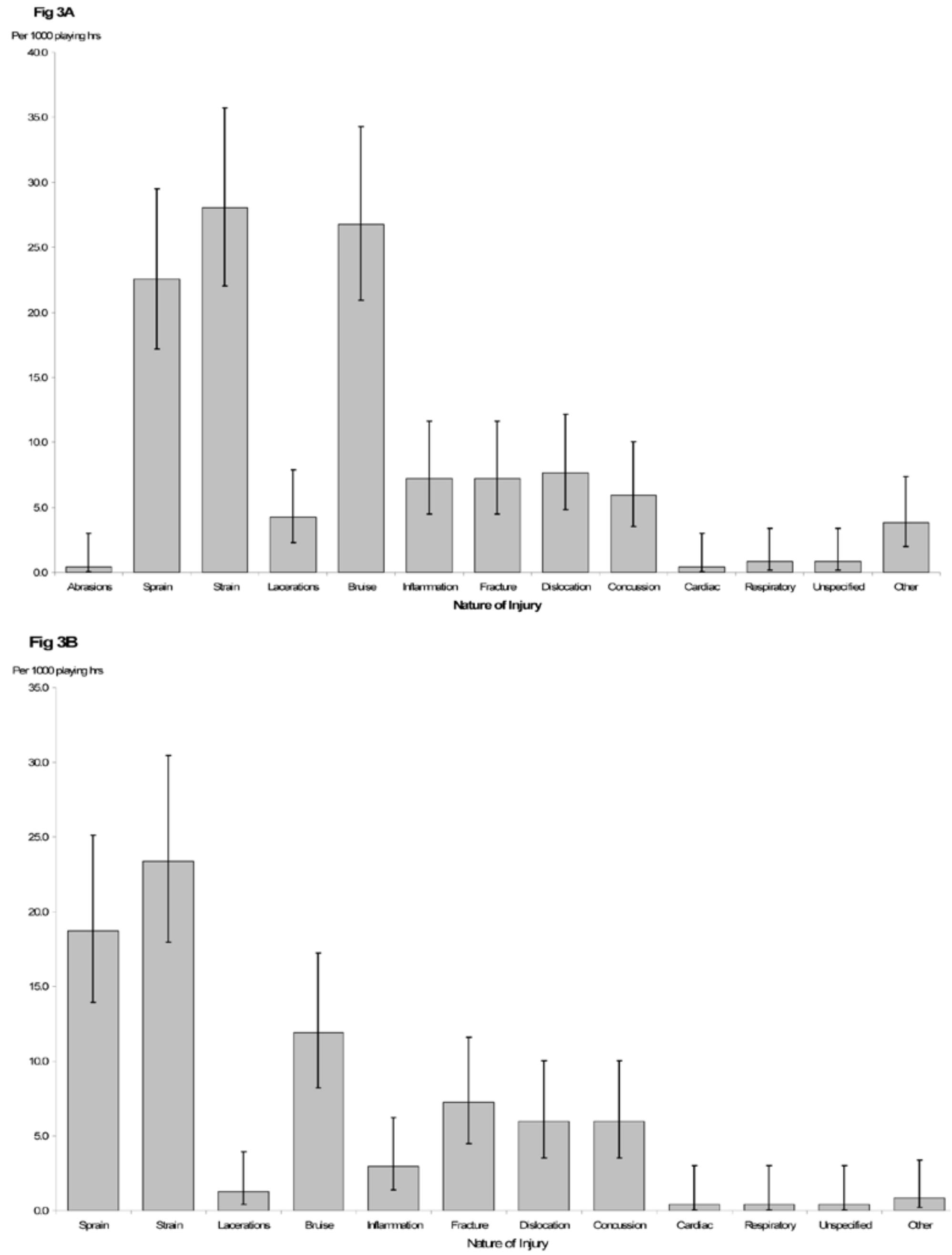


FIGURE 4: Cause of overall injuries (A) and injuries resulting in missed matches (B) with 95% confidence intervals for the 2005 New Zealand Bartercard Cup competition.

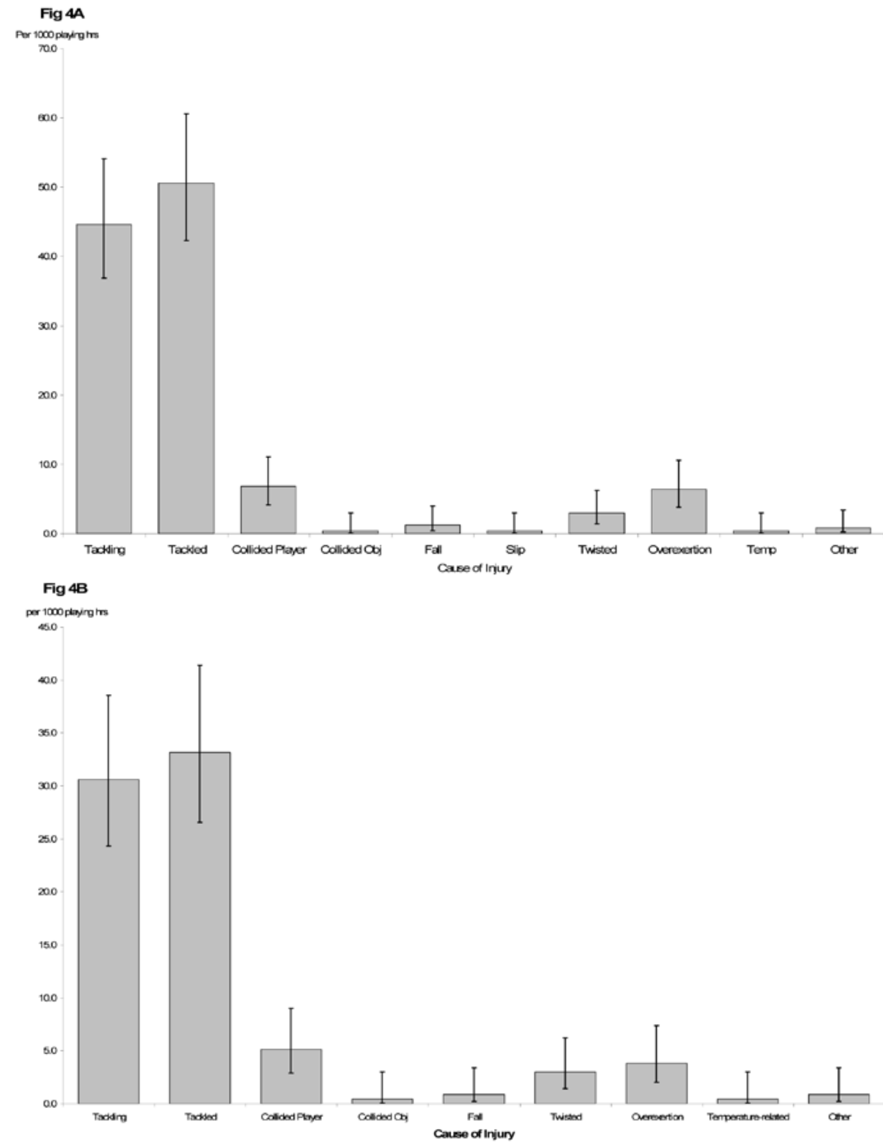


TABLE 3: Severity of injury for the 2005 New Zealand Bartercard Cup competition.

	FORWARDS			BACKS		
	No	Rate*	9%% CI	No	Rate*	95% CI
Transient	46	42.4	(31.7 – 56.6)	40	31.6	(23.2 – 43.1)
Minor	61	56.2	(43.7 – 72.2)	55	43.4	(33.4 – 56.6)
Moderate	24	22.1	(14.8 – 33.0)	20	15.8	(10.2 – 24.5)
Major	15	13.8	(8.3 – 22.9)	9	7.1	(3.7 – 13.7)

**Rate expressed per 1000 playing hours. CI, confidence intervals.*

Severity of Injury

There were more minor injuries recorded (49 per 1000 playing hours) than transient (37 per 1000 playing hours), moderate (19 per 1000 playing hours) and major (10 per 1000 playing hours) injuries (see Table 3).

Time of Injury

There was a significant difference between the first and second halves of matches (90 per 1000 playing hours vs. 138 per 1000 playing hours; X^2=13, df=1, p=0.0004) for total match injuries incidence (see Figure 5). More injuries occurred in the third quarter of matches for both total (168 per 1000 playing hours) and missed match (117 per 1000 playing hours) injuries. When comparing the first with the second half of the competition season (including the final series), there was a statistical significance observed for total injuries (114 per 1000 playing hours vs.118 per 1000 playing hours; X^2=8, df=1, p=0.005), and injuries resulting in missed matches (77 per 1000 playing hours vs. 81 per 1000 playing hours; X^2=5, df=1, p=0.027) with more injuries occurring in the first half of the competition season (see Table 4).

FIGURE 5: Match time by quarters with 95% confidence intervals for overall injuries (A) and injuries resulting in missed matches (B) for the 2005 New Zealand Bartercard Cup competition.

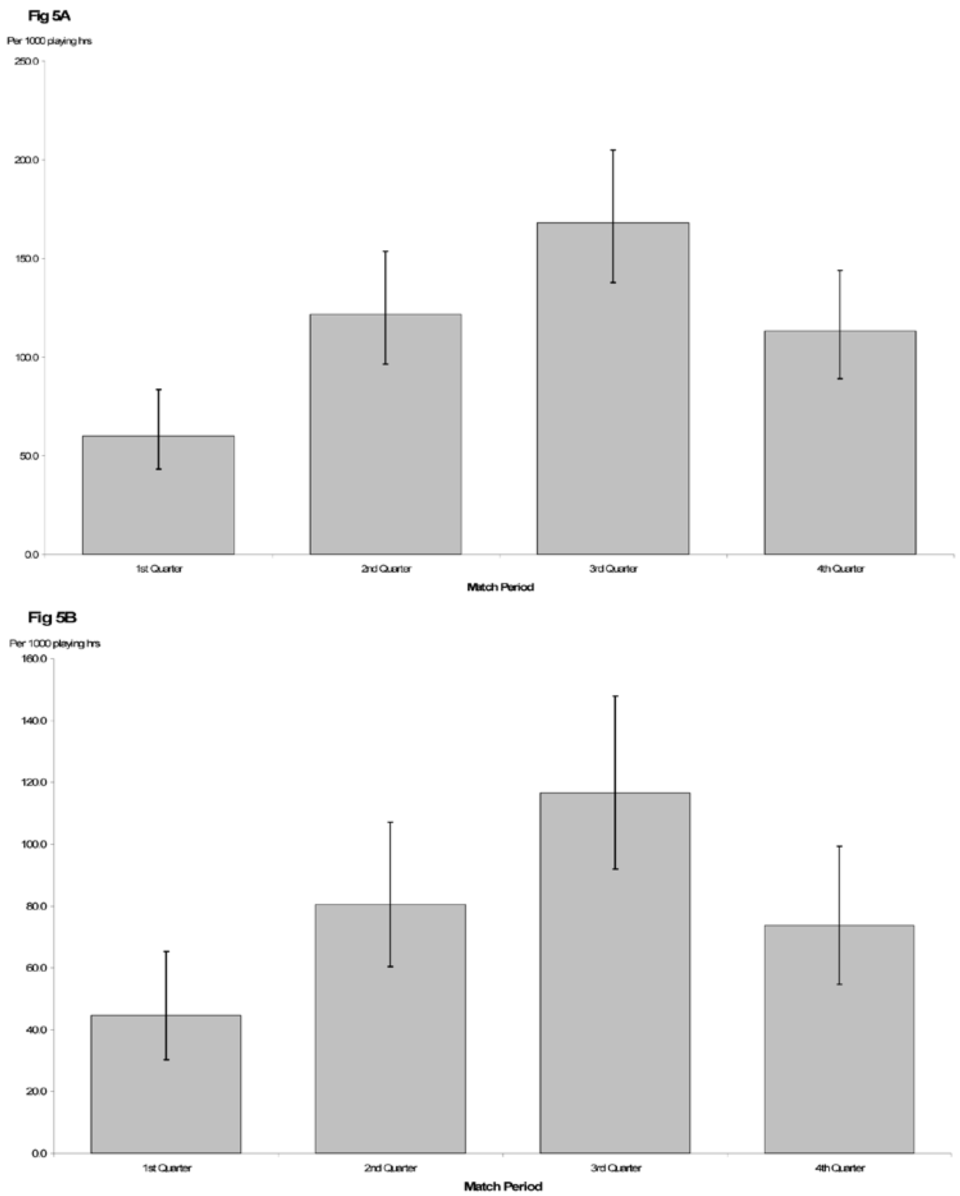


TABLE 4: Early and late season injuries for the 2005 New Zealand Bartercard Cup competition.

TOTAL INJURIES	**Forwards**			**Backs**		
	No	**Rate***	**95% CI**	**No**	**Rate**	**95% CI**
Early Season	83	130.0	(104.8 – 161.2)	75	100.7	(80.3 – 126.3)
Late Season	63	143.5	(112.1 – 183.7)	49	95.7	(72.3 – 126.6)
MISSED MATCH INJURIES	**Forwards**			**Backs**		
	No	**Rate***	**95%CI**	**No**	**Rate**	**95%CI**
Early Season	58	90.9	(70.2 – 117.5)	49	65.8	(49.7 – 87.0)
Late Season	42	95.7	(70.7 – 129.5)	35	68.4	(49.1 – 95.2)

**Rate expressed per 1000 playing hours. CI, confidence intervals.*

Home vs Away

A total of 68 'home' and 68 'away' matches were played. There was no statistical difference between total home and away venue injuries recorded (117 per 1000 playing hours vs. 113 per 1000 playing hours; X^2=0.1, df=1, p=0.81) and missed match (75 per 1000 playing hours vs. 82 per 1000 playing hours; X^2=0.4, df=1, p=0.55) injury incidences.

DISCUSSION

The purpose of this study was to investigate the incidence, site, nature, cause, and severity of injuries sustained during match participation in the 2005 New Zealand Bartercard Cup competition. The overall incidence of injury in the present study (114.8 per 1000 playing hours) was lower than previously reported for amateur (161 per 1000 playing hours),[9] semi-professional (825 per 1000 playing hours)[5,21,22] and professional (346 per 1000 playing hours)[12] rugby league players using an identical injury definition. In addition, when using an identical injury definition to a previous study of semi-professional rugby league players, the incidence of total injuries was noticeably less (115 per 1000 hours vs. 825 per 1000 hours) but by measuring missed matches, the studies were shown to be similar in injury incidence (78 per 1000 playing hours vs. 68 per 1000 playing hours).[5] This similar missed match injury incidence reinforces the need for a standardized injury definition in rugby league.

Recent attempts to establish a standardised injury definition in rugby league[23] have seen some, but not all researchers agree.[23, 24] Some were not in favour of a definition that was all encompassing and enabled non time-loss injuries to be recorded preferring to record time-loss injuries alone.[24,25] Although time loss injuries enable a more consistent inter study comparison to be conducted, studies have reported that non time-loss injuries can account for between 85%[26] to 93%[27] of match injuries, and up to 98%[27] of training injuries. The inclusion of non time loss injuries has been reported to bias the reported data towards non time loss injuries and, as a result of this bias, head and neck injuries make up a large proportion of the total injuries in rugby league.[28] Further development of an injury definition is necessary to enable a unified approach to the identification of the injury rate for all researchers in rugby league injury epidemiology.

The timing of the New Zealand competition was similar to other competitions - being held during the autumn, winter and spring seasons. Although previous studies have identified a progressive increase in the injury incidence throughout the season,[21] the variations observed throughout this competition warrant further exploration. These variations are: (1) the higher initial injury incidence (123 per 1000 playing hours) at the beginning of the season (April); (2) the increased injury incidence in the mid-season period (June), and (3) the increased injury incidence at the end of the season (September).

The higher initial injury incidence at the beginning of the competition season identified in this study may be related to poor match fitness and player conditioning.[9] A study on risk factors for injury in rugby league[21,29] have identified that players with less than 18 weeks of training, low sprint speed and a low estimated maximal aerobic power are at an increased risk of injury. No data was obtained on the anthropometric and physiological characteristics of participants, nor on the amount of pre-competition training the participants completed. Previous playing experience and previous injury history were also shown to be risk factors for subsequent injuries occurring.[21,29] A recommendation for subsequent studies in rugby league would be to include this data in the collection.

The increased incidence of injury in the mid-season period may be due to accumulation of micro-trauma and residual fatigue.[9] Semi-professional participants have been reported as having a higher fitness level than amateur participants but lower skill levels than professional players.[5,21,22] The higher fitness level may result in a higher playing intensity and, in some team situations, decreased rest and recovery between match and training sessions. This decreased recovery has been shown to result in accumulation of micro trauma from the physical nature of contact sports.[30] As well residual fatigue, associated with a limited recovery time between successive matches, may also compromise the musculoskeletal system of the participant. This may account for the number of tackle related injuries recorded. The increased fitness and strength of semi-professional participants may influence the intensity of the tackle, but the reduced skill level may influence the type of injury that occurs as a result of the tackle. Combined with residual fatigue and accumulated micro trauma, the risk of an injury occurring would be increased at this level of participation.

The increased injury incidence at the end of the season may be attributed to the ensuing finals series of the competition.[5] Some studies have reported higher injury rates at the end of the competition season suggesting changes in playing intensity at this stage of the competition.[5,31] The increased playing intensity may result in physiological demands being placed on the participant that are higher than the musculoskeletal system can tolerate. Gabbett[27] found a significant correlation (r=0.74) between match injury rates and match intensity in semi-professional participation. These findings would be expected as the intensity of the finals series approaches. Further studies are warranted to determine the appropriate match intensity level required to enable teams to be competitive but not place the participants at risk of excessive physiological demands.

The overall lower injury incidence, when compared to the other semi-professional study, may be related to environmental and ground conditions on which matches were played. The Australian study was undertaken on teams playing in the New South Wales and Queensland environment where ground conditions are recorded as harder and temperatures warmer.[5] The softer ground conditions and cooler temperatures in New Zealand may have aided in reducing the overall injury incidence but may also have contributed to the types of injuries that were recorded. In support of this hypothesis, it has recently been found[32] that harder ground conditions and lower 365-day rainfall is associated with increased injury risk in rugby league.

CONCLUSION

The finding that the majority of injuries occurred in the tackle is consistent with previous studies in amateur,[1] semi-professional[5] and professional studies.[13,14,33] The ball carrier recorded more injuries than the tackler which is similar to professional[13,14,33] and semi-professional[5] studies. In contrast, in amateur rugby league players, the tackler has been shown to sustain more injuries than the ball carrier.[1] Previous studies have suggested that a greater emphasis on dominating the ruck and the introduction of the 10m rule[5,34] combined with low speed and maximal aerobic power[29] may explain the differences in injury incidence between semi-professional and amateur levels of participation, but additional aspects of the tackle also need to be considered.

While the tackle is responsible for the majority of injuries in rugby league, there is no current research into the risk factors for tackle injuries in rugby league. Nor is there any published research on tackle types, height and sites in rugby league that result in injuries. Research is ongoing in this area but the results are unavailable at the time of this study being conducted (personal communication). Training activities designed to develop correct tackling technique may reduce the incidence of tackle-related injuries.[35,36] Participation in tackling technique training prior to and under fatigued conditions may assist in the reduction of tackle-related injuries to both the tackler and the ball carrier[1,35,36], however, to date, no evidence exists to support or refute these potential injury prevention strategies. Further research investigating risk factors for tackling injuries is warranted in an attempt to reduce the incidence of tackle-related injuries in rugby league.

Limitations

The study was conducted on only eight of the 12 teams that participated in the 2005 Bartercard Cup competition despite all teams being invited to participate. Although this study is one of a few studies to report on multi-team participation, the study was only conducted on one competition season. As well the competition has now been discontinued and a further study at this level of competition is no longer available in New Zealand. Consequently the current study is limited to being just a snap shot of the competition and is unable to explore seasonal variations of semi-professional participation. Training participation and training injury incidence data were also not gathered as part of this study and this data may have been useful to identify rest and recovery between matches, the training injury incidence and injury type in comparison with other studies in rugby league.

What is already known on this topic?

- Most rugby league studies use single teams or clubs to document injury rates.
- The incidence of injuries in semi-professional rugby league is high

What this study adds?

- This study is one of the few studies to utilize multiple teams to investigate the incidence of injury in rugby league.
- The incidence of missed match injuries is similar for semi-professional participants compared to amateur and professional participants despite there being a difference in the overall injury incidence.

Future Research

Possible future areas of research identified are:

- Risk factor analysis of tackle related injuries
- Previous playing experience and injury history on participants in relationship to current and ongoing injury incidence
- Determination of the appropriate match intensity level required to enable teams to be competitive but not place the participants at risk of excessive physiological demands
- Multi team competition over consecutive seasons to enable identification of seasonal variations.

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Conflict of Interest Statement

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Amateur rugby league match injuries in New Zealand

D A King MHealSc[1], **T J Gabbett** PhD[2]

1 Emergency Department
Hutt Valley District Health Board
Lower Hutt
NEW ZEALAND
2 Brisbane Broncos Rugby League Club
Red Hill
Queensland
AUSTRALIA

Correspondence to:
Doug King
Emergency Department
Hutt Valley District Health Board
Private Bag
Lower Hutt
NEW ZEALAND
Tel: +64 4 566 6999 ext 8118
Email: douglas.king@huttvalleydhb.org.nz

ABSTRACT

Objectives: **To describe the incidence, site, nature, severity and pattern of injuries in amateur male rugby league in New Zealand, and to compare these with other research findings.**

Methods: **A prospective cohort study was conducted on a premier level rugby league team in a division II domestic competition over one year. All injuries sustained during matches were recorded using a standardised injury reporting form. Injury data was collected from 17 matches. Information recorded included the date, time, player position, site, nature, cause and severity of injury.**

Results: **A total of 206 match injuries were recorded. The total injury incidence was 700 per 1000 playing hours. The incidence of injuries resulting in missed matches was 193 per 1000 playing hours.**

Conclusion: **The overall incidence of match injuries in the present study was significantly higher than those previously reported for amateur rugby league competitions. Changes in training volume and intensity towards the second half of the season, in combination with social stressors and an inadequate recovery period may explain the increasing injury incidence as the season progressed. Further studies of the relationship between stress, recovery, and injury incidence are warranted.**

Keywords: **rugby league, injury incidence, amateur competition, New Zealand**

INTRODUCTION

Beginning it's origins in the north of England,[1] the game of rugby league has become an internationally played collision sport.[1-4] It is played at professional, semi-professional, amateur and junior levels of competition.[1,4,5] The game of rugby league requires players to undergo repetitive physical contact activities such as tackles and collisions.[2,6,7] As a result, musculoskeletal injuries occur frequently.[2-4]

Several studies have been undertaken on the incidence, site, type and severity of injuries in rugby league.[5,6,12,16] These often vary according to the participation level[5,13,14] with elite players typically,[5,9] but not always[6] having a higher incidence of injury than non-elite players. When only injuries that result in missed matches are considered, the injury incidence ranges from 27[10] to 68[6] per 1000 playing hours. However, when all injuries (including transient injuries are considered), the injury incidence is as high as 825[6] per 1000 playing hours. The most common injury site in amateur rugby league has been shown to be the head and neck.[5,9] Forwards have been shown to sustain more injuries than backs,[9] and a higher injury rate has been recorded in the second half of matches suggesting that fatigue, or a fatigue-induced reduction in technique and/or concentration may contribute to injuries in rugby league.[6,15]

To date, few studies have investigated the incidence of injury in New Zealand rugby league players.[8-11] These studies have reported injury rates in conventional rugby league of 25[10] to 278[8] per 1000 playing hours, depending on the injury definition used. However at the time that this study was undertaken these studies were dated with no recent studies completed in New Zealand rugby league matches. The purpose of this study was to describe the incidence, site, nature, severity and pattern of injuries in amateur male rugby league in New Zealand, and to compare these with other research findings.

METHODS

A prospective cohort observational study was undertaken to document the incidence of injuries occurring in an amateur rugby league team over the 2006 domestic season. The season lasted from December 2005 through to August 2006 with competition games from March through to August. The team participated in the premier division of the competition comprising of six teams. All registered players were considered amateur as they derived their main source of income from other means and did not receive match payments.

Over the duration of the season all match injuries from the team were recorded. Injury data was collected on a standardised injury reporting form[2,11-13] from all 17 matches the team participated in. This included pre-season fixtures and all competition matches, including the final series. All matches were 80 minutes in duration.

Definition of Injury

The definition of an injury utilised for this study was *"any physical or medical condition that occurred during participation in a rugby league match that required medical treatment or resulted in missed match participation"* [14]. Injuries were also classified according to the number of matches lost as a result of the injury.[14]

Data Collected

Player position was recorded as the position that the player was undertaking at the time the injury occurred Injuries were classified by anatomical location, described according to the nature of the injury and recorded by the activity undertaken at the time of the injury. The time of injury was recorded by match quarters and the injury severity was based on time away from match and training participation.[2,5,11,13]

Statistics

Over the duration of the season there were 17 matches played. All matches were 80 minutes (1.33 hours) in duration with a total injury exposure of 293.9 hours. The injury rates were calculated as described previously.[15] Expected injuries were the same proportion of the total injuries as that month's exposure hours were of the total hours.[15] A one-sample chi-squared (X^2) test was used to determine whether the observed injury frequency was significantly different from the expected injury frequency. Data are reported as means and 95% confidence intervals (CI). The level of significance was set at $p<0.05$. Significant p values reported in the text are less than 0.0001 if they are not specifically stated. Injury rates are reported per 1000 playing hours.

RESULTS

The monthly total match and missed match injuries statistics are shown in table 1. The total injury incidence (700 per 1000 playing hours) is significantly higher than previously reported total injury incidences for amateur (161 per 1000 playing hours[4]; X^2= 438, df=1), semi-professional (825 per 1000 playing hours[13]; X^2=4, df=1, p=0.0272) and professional (214 per 1000 playing hours[16]; X^2=163, df=1; 462 per 1000 playing hours[15]; X^2=29, df=1) levels of participation. This was similar for missed match injuries when compared with semi-professional (68 per 1000 playing hours[13]; X^2= 49, df=1) and professional (45 per 1000 playing hours[17]; X^2=105, df=1) levels of participation.

TABLE 1: Match injury statistics per month for rates, player hours for total and missed match injuries with 95% confidence intervals.

		March	April	May	June	July	August	Total
	No matches completed	1	1	4	3	4	4	**17**
	Exposure hrs	17.29	17.29	69.16	51.87	69.16	69.16	**293.93**
TOTAL INJURIES	Observed	11	6	34	45	54	56	**206**
	Expected	12.1	12.1	48.5	36.4	48.5	48.5	**206**
	Injury incidence	636.2	347	496.1	867.6	780.8	809.7	**700.8**
	95% CI*	(352.3–1148.8)	(115.9–772.4)	(351.3–688.0)	(647.7–1162.0)	(598.0– 019.5)	(623.1–1052.2)	**(611.4–803.4)**
MISSED MATCH INJURIES	Observed	3	3	10	12	15	14	**57**
	Expected	3.4	3.4	13.4	10.1	13.4	13.4	**57**
	Injury incidence	173.5	173.5	144.6	231.3	216.9	202.4	**193.9**
	95% CI*	(56.0-538.0)	(56.0-538.0)	(77.8-268.7)	(131.4-407.4)	(130.8-359.8)	(119.9-341.8)	**(149.6-251.4)**

**CI: Confidence Intervals. Injury incidence reported per 1000 playing hours.*

ORIGINAL ARTICLE

Player Position

Individual player position injury incidence for total and missed match injuries is shown in table 2. Second row players recorded more total injuries (112 per 1000 playing hours) than all other playing positions while wingers and props recorded more injuries resulting in missed matches (31 per 1000 playing hours) than all other playing positions. There was no significant difference in the incidence of injury between forwards and backs for total injuries (638 per 1000 playing hours vs. 774 per 1000 playing hours; X^2=2, df=1, p=0.1655) and injuries resulting in missed matches (213 per 1000 playing hours vs. 145 per 1000 playing hours; X^2=2, df=1, p=0.1643).

TABLE 2: Injuries by playing position for total injuries and injuries resulting in missed matches for New Zealand amateur rugby league players with 95% Confidence Intervals and percentages.

	TOTAL MATCH INJURIES				MISSED MATCH INJURIES			
	No	Rate*	95% CI	%	No	Rate	95% CI	%
Fullback	21	928.8	(605.6 – 1424.5)	10.2	4	176.9	(66.4 – 471.4)	7.0
Wing	32	707.7	(500.4 – 1000.7)	7.3	13	287.5	(166.9 – 495.1)	22.8
Centre	24	530.7	(355.7 – 791.8)	4.9	4	88.5	(33.2 – 235.7)	7.0
Stand-Off	8	353.8	(176.9 – 707.5)	6.8	1	44.2	(6.2 – 314.0)	1.8
Halfback	10	442.3	(238.0 – 822.0)	8.3	1	44.2	(6.2 – 314.0)	1.8
Prop	33	729.8	(518.8 – 1026.5)	3.9	12	265.4	(150.7 – 467.3)	21.1
Hooker	21	928.8	(605.6 – 1424.5)	4.9	5	221.1	(92.0 – 531.3)	8.8
Second Row	39	862.5	(630.1 – 1180.4)	8.3	12	265.4	(150.7 – 467.3)	21.1
Loose Forward	18	398.1	(250.8 – 631.8)	10.2	5	221.1	(92.0 – 531.3)	8.8

**Rates expressed per 1000 playing hours. CI, confidence intervals.*

Site of Injury

The thigh (75 per 1000 playing hours) and lower leg (75 per 1000 playing hours) were the most common injury sites for total injuries. The shoulder (30 per 1000 playing hours) and head (27 per 1000 playing hours) were the most common injury sites resulting in missed match injuries (see Table 3). Nearly 40% of injuries recorded occurred in the lower limbs for both total (272 per 1000 playing hours) and missed match (75 per 1000 playing hours) injuries. The head and neck incurred 34.0% of total (238 per 1000 playing hours) and 24.6% of missed match (48 per 1000 playing hours) injuries.

TABLE 3: Site of total injuries and injuries resulting in missed matches for New Zealand amateur rugby league players with 95% confidence intervals and percentages.

	TOTAL INJURIES				TOTAL INJURIES			
Injury Site	No	Rate*	(95% CI)	%	No	Rate*	(95% CI)	%
Head	19	64.6	(41.2-101.3)	9.2	8	27.2	(13.6-54.4)	15.4
Eye	14	47.6	(28.2-80.4)	6.8	1	3.4	(0.5-24.2)	1.9
Nose	11	37.4	(20.7-67.6)	5.3	1	3.4	(0.5-24.2)	1.9
Mouth	18	61.2	(38.6-97.2)	8.7	2	6.8	(1.7-27.2)	3.8
Neck	8	27.2	(13.6-54.4)	3.9	1	3.4	(0.5-24.2)	1.9
Shoulder	14	47.6	(28.2-80.4)	6.8	8	27.2	(13.6-54.4)	15.4
Upper Arm	5	17.0	(7.1-40.9)	2.4	0	0.0	-	0.0
Elbow	2	6.8	(1.7-27.2)	1.0	0	0.0	-	0.0
L Arm	3	10.2	(3.3-31.6)	1.5	1	3.4	(0.5-24.2)	1.9
Wrist	5	17.0	(7.1-40.9)	2.4	2	6.8	(1.7-27.2)	3.8
Hand	4	13.6	(5.1-36.3)	1.9	1	3.4	(0.5-24.2)	1.9
Finger	8	27.2	(13.6-54.4)	3.9	1	3.4	(0.5-24.2)	1.9
Thumb	4	13.6	(5.1-36.3)	1.9	1	3.4	(0.5-24.2)	1.9
Chest	9	30.6	(15.9-58.8)	4.4	4	13.6	(5.1-36.3)	7.7
Back	2	6.8	(1.7-27.2)	1.0	1	3.4	(0.5-24.2)	1.9
Groin	9	30.6	(15.9-58.8)	4.4	5	17.0	(7.1-40.9)	9.6
Thigh	22	74.8	(49.3-113.7)	10.7	4	13.6	(5.1-36.3)	7.7
Knee	21	71.4	(46.6-109.6)	10.2	7	23.8	(11.4-50.0)	13.5
Lower Leg	22	74.8	(49.3-113.7)	10.7	3	10.2	(3.3-31.6)	5.8
Ankle	4	13.6	(5.1-36.3)	1.9	1	3.4	(0.5-24.2)	1.9
Toe	2	6.8	(1.7-27.2)	1.0	0	0.0	-	0.0

**Rates expressed per 1000 playing hours. CI, confidence intervals.*

Nature of Injury

The nature of the injuries for total and missed match injuries is shown in table 4. Contusions were more common for total injuries (313 per 1000 playing hours) while sprains and strains were more common for missed match injuries (60.2 per 1000 playing hours).

TABLE 4: Nature of total injuries and injuries resulting in missed matches for New Zealand amateur rugby league players with 95% confidence intervals and percentages.

	TOTAL INJURIES				MISSED MATCHES			
	No	Rate*	(95% CI)	%	No	Rate*	(95% CI)	%
Lacerations and Abrasions	24	81.7	(54.7-121.8)	11.7	1	3.4	(0.5-24.2)	1.9
Sprains and Strains	54	183.7	(140.7-239.9)	26.2	26	88	(60.2-129.9)	50.0
Contusions	92	313.0	(255.2-384.0)	44.7	5	17	(7.1-40.9)	9.6
Fractures	8	27.2	(13.6-54.4)	3.9	7	24	(11.4-50.0)	13.5
Dislocations	7	23.8	(11.4-50.0)	3.4	4	14	(5.1-36.3)	7.7
Concussion	8	27.2	(13.6-54.4)	3.9	8	27	(13.6-54.4)	15.4
Other	13	44.2	(25.7-76.2)	6.3	1	3.4	(0.5-24.2)	1.9

**Rates expressed per 1000 playing hours. CI, confidence intervals.*

Cause of Injury

Most injuries occurred in tackles and physical collisions. The ball carrier recorded significantly more injuries than the tackler in total injuries (405 per 1000 playing hours vs. 133 per 1000 playing hours; X^2 =40 df=1) but there was no significant difference for injuries resulting in missed matches (85 per 1000 playing hours vs. 51 per 1000 playing hours; X^2 = 3, df=1, p>0.05) (see Table 5).

TABLE 5: Cause of total injuries and injuries resulting in missed matches for New Zealand amateur rugby league players with 95% confidence intervals and percentages.

	TOTAL INJURIES				MISSED MATCHES			
	No	Rate*	(95% CI)	%	No	Rate*	(95% CI)	%
Tackler	39	132.7	(96.9-181.6)	18.9	13	44.2	(25.7-76.2)	25.0
Ball carrier	119	404.9	(338.3-484.5)	57.8	24	81.7	(54.7-121.8)	46.2
Collision	9	30.6	(15.9-58.8)	4.4	2	6.8	(1.7-27.2)	3.8
Fall/Slip/Twist	7	23.8	(11.4-50.0)	3.4	4	13.6	(5.1-36.3)	7.7
Exertion	27	91.9	(63.0-133.9)	13.1	6	20.4	(9.2-45.4)	11.5
Other	5	17.0	(7.1-40.9)	2.4	3	10.2	(3.3-31.6)	5.8

**Rates expressed per 1000 playing hours. CI, confidence intervals.*

Severity of Injury

Transient injuries were more common (507 per 1000 playing hours) while minor (106 per 1000 playing hours), moderate (31 per 1000 playing hours) and major (58 per 1000 playing hours) injuries were less common.

Time of Injury

There was a significant difference observed between first and second half of matches for total (520 per 1000 playing hours vs. 871 per 1000 playing hours; X^2 = 13, df=1) and injuries resulting missed matches (95 per 1000 playing hours vs. 257 per 1000 playing hours; X^2 = 13, df=1) (see Table 6). There were no significant differences observed between the first and second half of the playing season for total (617 per 1000 playing hours vs. 706 per 1000 playing hours; X^2 = 0.9, df=1, p=0.3293) and missed matches (366 per 1000 playing hours vs. 471 per 1000 playing hours; X^2 = 0.0, df=1, p=0.7899) injuries.

TABLE 6: Time of injury by match halves for total injuries and injuries resulting in missed matches for New Zealand amateur rugby league players with 95% confidence intervals and percentages.

	TOTAL INJURIES				MISSED MATCHES			
	No	Rate*	(95% CI)	%	No	Rate*	(95% CI)	%
1st Half of match play	77	520.0	(415.9-650.2)	37.4	14	95.3	(56.4-160.8)	26.9
2nd half of match play	129	871.2	(733.1-1035.3)	62.6	38	256.6	(186.7-352.7)	73.1

**Rates expressed per 1000 playing hours. CI, confidence intervals.*

DISCUSSION

Although there have been overseas studies on amateur rugby league injuries,[4,5,18] there have been no recent studies in New Zealand on amateur rugby league match injuries. Previous rugby league injury studies in New Zealand have been undertaken through the use of self-reported injury forms[8] or by reviewing statistics from the Accident Compensation Corporation.[9] The use of a prospective cohort study on New Zealand rugby league injuries has been published on a national rugby league seven's tournament[2] and a national junior competition[11] but no specific amateur team studies have been completed. This study was to describe the incidence, site, nature, severity and pattern of injuries in amateur male rugby league in New Zealand, and to compare these with other research findings. It is hoped that this will encourage and develop further long-term studies from different districts in New Zealand.

The majority of injuries occurred in the tackle which is consistent with studies on junior,[19] amateur,[18] semi-professional[13] and professional[6,20] levels of participation. As well, the ball carrier sustained more injuries than the tackler which is also consistent with previous studies in junior,[19] professional[13] and semi professional[6,20] participation but in contrast with studies in amateur[18] rugby league. Amateur players have been reported to have a lower fitness and skill level than professional and semi-professional players.[1,3,13] This may be a contributing factor to the incidence of tackle related injuries found in this study. Amateur players often do not have access to the qualified performance enhancement staff that would normally be assigned to elite competitions and, although they may undertake skills and conditioning training, the skills taught and activities undertaken may not incorporate the best techniques. As rugby league in New Zealand is viewed as one of the lesser played sports compared with rugby union and soccer,[21] the resources and funding for ongoing training and skill upgrading is limited. This limited upgrading in activities such as match skills and training techniques may also be reflected in the type and style of tackling used in matches and the subsequent high injury incidence.

In contrast to previous studies of amateur rugby league injuries,[4] this study identified the lower limbs to have sustained the highest incidence of total injuries. This finding may be contributed to by the limited access to qualified performance enhancement staff previously discussed. Despite this finding, the head and neck accounted for a third of the total injuries and a quarter of missed match injuries. The high incidence of head and neck injuries sustained by the ball carrier may indicate the effects of poor tackling techniques at this level of competition. Concussions sustained by the ball carrier were higher than previously reported for amateur competitions.[4] Although injuries to the shoulder were less commonly recorded, this was the injury site resulting in the highest number of missed matches in this study. This is consistent with some,[11,19] but not all,[4,13] studies in rugby league. Given that fatigue has been reported to contribute to injuries in rugby league,[4] and fatigue reduces tackling proficiency,[22] the findings of shoulder injuries and tackle related injuries could be expected.[23] This finding warrants further exploration at the amateur rugby league level of participation to enable development of injury prevention programs. These injury prevention programs should include game specific defensive and attacking drills practiced under various levels of fatigue to correctly execute skills when under pressure and fatigued states in match play.[19]

The finding that more injuries were recorded in the second than the first half of the playing season is in agreement with other studies on amateur rugby league. Other studies have suggested that environmental conditions and ground hardness may have a greater influence on the late season injury incidence,[24] although recent evidence has demonstrated that ground conditions contribute to injury risk independent of the stage of season.[25] The majority of injuries to the head and neck region, and those resulting in concussions, occurred in the second half of matches and the second half of the competitive season. This finding may reflect the influence of residual fatigue and possible stressors on players recovering from previous competitive matches. Changes in training volume and intensity[26,27] towards the second half of the season in combination with social stressors[28] and an inadequate recovery period[26-29] may contribute to the increasing injury incidence as the season progressed. Further studies of the relationship between stress, recovery, and injury incidence are warranted.

CONCLUSION

The purpose of this study was to describe the incidence, site, nature, severity and pattern of injuries in amateur male rugby league in New Zealand, and to compare these with other research findings. Although there are some similarities between the findings of this study and previous studies in rugby league, this study has shown that in one New Zealand district, the incidence of injuries for amateur rugby league was higher than other studies on junior, amateur and professional level competitions.

Limitations

This study is limited by the use of only one team in one competition over a single season. As well the player based was limited to just 50 players in the team for the competition season. The results of this study should be taken as a snap shot of the injuries in New Zealand in a Division II competition.

Future Research

- Further long term studies from different districts, or a multi-district prospective study on the incidence of injuries in amateur rugby league competitions in New Zealand would enable further clarification on the actual total and missed match injury incidence, the incidence of tackle related injuries and whether there are differences between different amateur competitions throughout New Zealand.
- Further studies of the relationship between stress, recovery, and injury incidence are warranted
- Additional research identifying risk factors for injury (e.g. tackling technique and physical fitness levels) in amateur rugby league players is also warranted.

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Conflict of Interest Statement

No funding was received in the conducting of this manuscript. No conflicts of interests are declared.

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Delayed union of the olecranon epiphyseal plate in a competitive overhead athlete

Dieter Cadosch MD PhDc and **Oliver P Gautschi** MD

Department of Orthopaedic and Trauma Surgery
Royal Perth Hospital
Perth
Australia

Correspondence to:
Dieter Cadosch, MD PhDc
The University of Western Australia
School of Anatomy & Human Biology
35 Stirling Highway
Crawley WA 6009
Phone: +61 8 6488 3647
Mobile: +61 4 2039 1889
Fax: +61 8 6488 1051
E-mail: dcadosch@gmx.net

INTRODUCTION

Stress fractures are a relatively common occurrence in athletes, accounting for 1.4–4.4% of all sporting injuries[5]. One of the most common sites for stress fractures among overhead athletes is the olecranon[8]. Repetitive and excessive muscular forces imparted to the olecranon during the release phase of the throwing motion, along with impingement of the olecranon against the medial wall and base of the olecranon fossa, may produce stress type injuries to the elbow, including stress fractures and abnormalities in the olecranon physis[9,11]. We report the case of a conservatively treated non-uniting epiphyseal plate of the olecranon with a long term follow-up in a competitive adolescent baseball pitcher.

CASE REPORT

A 15 year-old, right-hand dominant Caucasian male presented to our clinic complaining of a posterior right elbow pain associated with throwing. He had played competitive baseball for the last five years as a pitcher, and reported no prior injuries to the right elbow. During the previous two months he had experienced pain and loss of power in his pitching elbow. The pain subsided within hours of ceasing pitching and there was no discomfort during regular everyday activities.

On the initial physical examination, he showed a normal muscular and skeletal development with symmetrical upper limbs without apparent deformity. The right upper extremity was neuro-vascularly intact and no signs of inflammation were identified. On palpation, there was no tenderness of the elbow, including the olecranon and the ulnar collateral ligament. He had a negative Tinel's sign over the cubital tunnel. The only clinical finding was a ten-degree flexion contracture in the involved elbow. The range of motion in flexion, supination, and pronation were free without any noted instability of the elbow.

Radiographs revealed a non-uniting olecranon physis, characteristic of a minimally displaced Salter-Harris type 1 fracture, but with no other abnormalities (Fig. 1). Radiographs of the contralateral elbow showed an almost fused epiphyseal plate (Fig. 2). Magnetic resonance imaging (MRI) revealed a widening of the epiphyseal plate of the right olecranon associated with adjacent bone marrow edema. This appearance is consistent with a chronic apophyseal stress injury with resultant delayed fusion of the epiphyseal plate.

A conservative treatment was chosen and it was recommended that the patient cease all sporting and other high demand activities. Additionally, physiotherapy instructions for light strengthening were given. At the eight-week follow-up the patient indicated complete alleviation of the symptoms. The radiological and physical investigations revealed unchanged findings. Henceforward, he gradually resumed normal life activity and pitching. He was able to progress to his previous level of pitching after six months without a recurrence of his symptoms. An additional clinical examination at the 15-month follow-up revealed a painless full range of movement of the dominant elbow with elbow extension returned to zero (symmetrical to the left side). There was no point tenderness or swelling over the right olecranon. Furthermore, radiographs (performed outside our clinic) made two years after the first onset of symptoms, demonstrated an almost fused epiphyseal plate.

DISCUSSION

In overhead athletes the elbow is one of the most common sites of overuse injuries, including musculotendinous tear (e.g. flexor-pronator muscle), strain of the ulnar collateral ligament, ulnar neuritis, avulsion fractures (e.g. medial epicondyle) and loose bodies[1]. The intense and repetitive stress, imparted throughout the throwing motion to the elbow of a skeletally immature individual can result in a painful physis. Without cessation of the applied stress, the physis may widen and lead to a persistent and painful physis in the adult[6,7]. Additionally, stress fractures of the olecranon have rarely been reported in the form of case reports, in the presence or absence of the olecranon physis, in pitchers, javelin throwers, gymnasts and weight lifters[2,5,7,10].

The biomechanical mechanism of olecranon stress fractures is thought to be due to the repetitive and explosive muscular forces imparted to the olecranon such as during the ball release and follow through phase of throwing. The combination of extension and valgus overload during the throwing motion results in tensile forces along the medial stabilizing structures, with compression on the lateral compartment and shear stress posteriorly[3]. The tensile forces medially in combination with the shear stress posteriorly and the impingement of the olecranon against the medial wall and base of the olecranon fossa can lead to stress fractures of the olecranon. In the immature skeleton the biomechanically weaker physis may represent the "predisposed breaking point".

The management of olecranon stress fractures (especially in competitive athletes and adolescents) is still controversial between conservative treatment[1,4,7] and early surgical intervention with internal fixation plus autologous bone grafting if necessary[2]. Unfortunately, the follow-up has been short, especially in the conservatively treated cases; with limited information about the patient outcome and performance[8]. The process of fracture healing is slow in the middle-third of the olecranon and withholds the risk of secondary displacement[10]. Additionally, the incidence of delayed and non-union is higher after conservative treatment[11]. However, it is in our opinion that minimally or non-displaced transverse stress fractures of the olecranon can be successfully treated with a conservative approach (activity restriction and immobilization if required) if the duration of the symptoms is short, such as 2-3 months, and previous treatment has not been rendered. Such an approach can also be recommended for high-demand overhead athletes.

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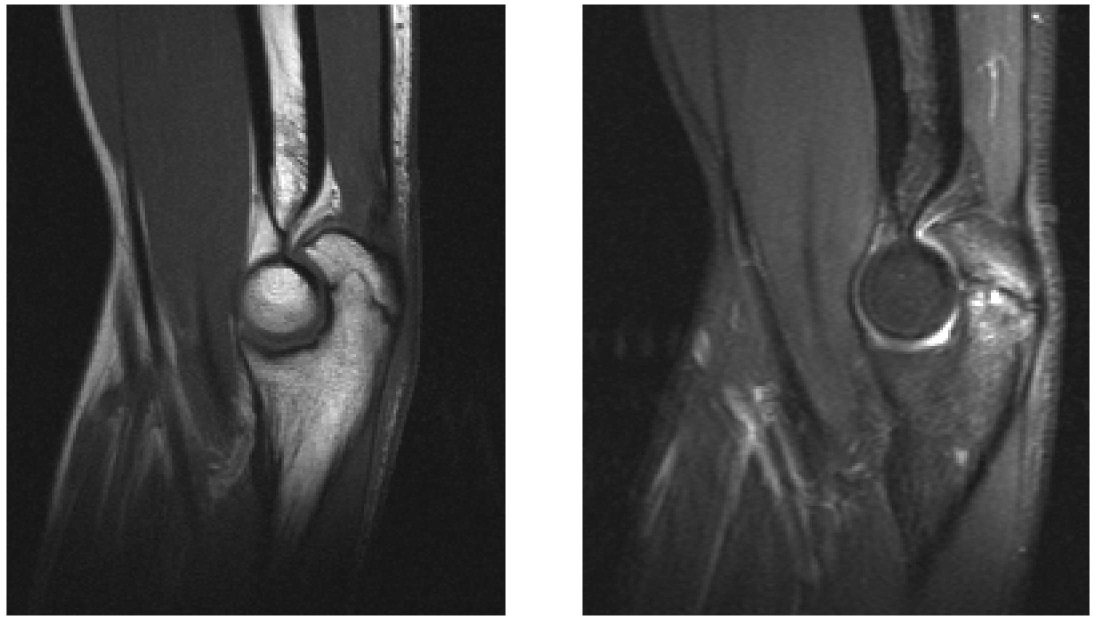
FIGURE 1 (a,b): An anteroposterior and lateral radiograph of the right elbow showing a fracture through the growth plate of the olecranon.

CASE REPORT

FIGURE 2 (a,b): MRI (T1 and Tirm sequence) of the right elbow showing a widening of the epiphyseal plate of the olecranon and associated adjacent bone marrow oedema.



Contact dermatitis from adhesive athletic tape in a rugby union player

J F Baker[1] MBChB, **B M Devitt**[2] MCh

1 Research Registrar
Department of Orthopaedic Surgery
Sports Surgery Clinic
Dublin

2 Specialist Registrar
Department of Orthopaedic Surgery
Cappagh National Orthopaedic Hospital
Dublin

Correspondence to:
Dr Joseph Baker
94 High Park
Gracepark Road
Dublin 9
E-mail: joseph.f.baker@gmail.com

INTRODUCTION

Contact dermatitis may be encountered in sports participants for a number of reasons. There is an extensive list of potential irritants, both in the athletic environment and among items used directly by the athlete, that may cause a dermatitis[7]. We present the case of a rugby union player who sustained a contact dermatitis following the use of adhesive tape for supporting a shoulder injury. This was the first reaction of this kind in the individual and a simple solution was found.

Despite widespread use of this treatment in athletes, there are few reports to illustrate this potential reaction. This case highlights a possible adverse reaction to a common treatment and illustrates one possible mode of prevention.

THE CASE

A 25-year-old male rugby player had sustained a Grade 1 acromio-clavicular (AC) joint sprain in a tackle during an amateur rugby match. He finished the game and continued training the following week with significant discomfort. The injury was diagnosed clinically and confirmed with weight bearing x-ray of the affected joint. Prior to the next match he had supportive adhesive strapping placed across the injured joint. Following the game and removal of the strapping a contact dermatitis was noted clearly in the distribution of the taped area (see Figure 1).

The player had no history of similar reaction to adhesive or any other topical substance. While he had no formal medical history nor took any regular medication, on further enquiry he had symptoms consistent with allergic rhinitis. His Northern European ethnicity suggested a predisposition to atopy. A pre-participation medical screen was not routine at the level of competition.

The dermatitis was treated with a short course of topical steroid cream and then settled. The following week he played in a competitive match and a layer of Omnifix (HARTMANN-CONCO Inc., Rockhill, SC) – a non-irritant retention tape - was placed beneath the adhesive strapping used previously. No further skin irritation was encountered and subjectively the support was considered by the player to be as effective as previously.

DISCUSSION

We have reported a case of contact dermatitis secondary to a commonly used treatment modality of musculoskeletal injury. Adhesive sports taping is used across many codes, in particular the football codes, but also track and field and court sports.[7] Its effectiveness in rugby union at least had been well discussed in the literature.[5, 6]

While the application of adhesive athletic tape is widespread, this case demonstrates a potential complication of its use. Reactions to athletic tape have been reported previously in basketball and in soccer.[1-3, 8] Shono *et al* reported a reaction to para-tertiarybutylphenol-formaldehyde resin (PTBP-FR) in adhesive athletic tape in a basketball player.[8] In soccer contact dermatitis has been reported, confirmed by patch testing, secondary to tincture of Benzoin used with the tapes.[1-3]

Adverse dermatological reactions to a variety of adhesive tapes used in the hospital setting are perhaps better reported in the literature. It is felt by some that the skin reaction to these adhesive tapes is not a true allergy and is best considered as an irritant contact dermatitis.[9] This consideration differs to the opinion of others who feel the reaction is a true allergy and this has been confirmed by patch testing in certain cases.[8] While the irritant type is due to chemical damage to the skin and is non-allergenic, clinically distinguishing between the irritant and allergic types clinically is often not possible.[4]

Repetitive use of adhesive tapes has been found lead to increased irritation and there may be a seasonal variation in their effect. The supportive tape used in the above case contained a zinc oxide adhesive substance. A preventive approach of course will involve avoiding use altogether and prevention is warranted given the potential for secondary infections. However, we have demonstrated a potential solution in those individuals with a dermatological reaction in the form of a non-irritant base layer of tape underneath the actual supporting material.

This case also highlights the potential value in obtaining a succinct medical history from athletes of whom care is undertaken on the sports field. While the player in question had no formal medical history, particularly no history of dermatitis, the symptoms suggestive of a predisposition to atopy may have alerted a team physician to the possibility of such a reaction. Although ideal, at this amateur level of competition pre-season or pre-participation medical assessment is not yet routine.

In summary, adhesive sports tape is widely used and a potential cause of contact dermatitis. Although the symptoms of dermatitis can be easily treated, in this situation it has a potentially easy prevention in the form of using a base layer of non-irritant tape. A well-performed medical assessment may assist in predicting which athletes are at risk of this adverse reaction. Skin testing in suspect individuals may be warranted to prevent this problem.

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Comment

This article by Dr Joseph Baker highlights the problem of a contact dermatitis to strapping tape commonly seen amongst rugby players as well as other athletes. It also highlights both effective treatment with a low potency topical steroid as well as the prevention of recurring contact dermatitis with subsequent strapping by the use of a suitable hypoallergenic tape applied to the area to be strapped before the chosen strapping tape is applied, eg, Fixomull tape is applied below Zinc Oxide tape.

Finally, it is appropriate for the strapper to enquire of the athlete of any previous known reaction to the tape before any is applied. This I believe is taught on the SMNZ sports first aider course. This article is a well illustrated reminder of a relatively minor but significant adverse effect "to strapping tape that is easily avoided ...".

Dr Paul Kennedy
General Practitioner
Te Awamutu

CASE REPORT

FIGURE 1: Contact dermatitis within the distribution of adhesive athletic tape used for support.

Low back pain in a competitive butterfly swimmer

Chris McCullough DipPhty, DipMT

Principal Physiotherapist
Forrest Hill Physiotherapy Clinic
Auckland

Correspondence to:
Chris McCullough
Forrest Hill Physiotherapy
Forrest Hill
Auckland
Email: info@foresthillphysio.co.nz

INTRODUCTION

Low back pain is a relatively common complaint in butterfly swimmers. We report the case of a 17 year old competitive butterfly swimmer.

The patient was 17 year old female former competitive butterfly swimmer who had experienced lumbar pain for 2Ω years. She had previously been evaluated by an orthopaedic specialist and MRI scan had revealed an annular tear of the L5/S1 disc.

Symptoms included central pain with radiation to both buttocks, more so on the right. The pain was aggravated by prolonged sitting and standing and eased by supine lying plus movement, heat and the use of Celebrex, a cox-2 agent. She was referred to our clinic for rehabilitation.

Past treatment had included soft tissue therapy, acupuncture and non-specific exercises with only short term relief.

Examination revealed moderate restriction of lumbar extension and oblique extension in either direction with poor activation of transversus abdominus and tight rectus femoris. There was tenderness on palpation at L5/S1 level.

Treatment was divided into several phases. The aim was to stabilise the posterior elements as proposed by previous published data from O'Sullivan, Sahrmann and Hides:

Phase 1 consisted of local stabilisation exercises utilising co-contraction of transversus abdominus and multifidus. She was instructed in self-management technique to maintain optimal posture including pause recovery and use of a lumbar roll. There was liaison with other family members with regard to ensuring compliance and support for her, plus her GP and referring specialist.

Phase 2 involved fortnightly Pilates rehabilitation exercises supervised within our clinic from Week 8 onwards. A progressive series of mat and reformer exercises were followed with flexion and extension introduced from Week 16.

Phase 3 involved a home exercise programme of 30 minutes three to four times per week with supplementary exercises from appropriate Pilates videos.

RESULTS

At three months she had improved by 90% on a visual analogue score, with minor residual pain with prolonged standing.

Complete resolution of symptoms was achieved by five months; she was able to self-manage her problems without the requirement for medication and progressively resume all life activities including a gymnasium programme, dance exercise and rock climbing. She was able to undertake an overseas trip, including a working holiday in North America, without a relapse of symptoms.

DISCUSSION

The usual mechanism of low back injury in butterfly swimmers is lumbar hyperextension and shearing forces coupled with rapid increases in training loads. In an athlete with underlying trunk instability, these forces overcome the body's ability to maintain stability in the lumbar spine. A progression of changes has been documented and initially includes discal pathology but may progress to involvement of the posterior elements of the spine. Pars interarticularis injuries including spondylolysis with progression to stress fracture of the pars interarticularis; if such stress fractures are bilateral then there may be forward slip of one vertebra on another (spondylolisthesis).

This case exemplifies the need for specific treatment tailored to the clinical problem. Education and empowerment were the cornerstones of treatment. It also exemplifies the sports medicine model of a team approach to management with involvement of the patient's family plus her GP and referring specialist. Adolescents have a different spectrum of pathology to adults, with a predominance of posterior element dysfunction and specific treatment needs to be tailored to address this pathology.

Commonwealth Youth Games Pune, India, 2008

Rosalind Wilson MBChB, PGDipSportsMed

Health Team Leader
New Zealand Team

Commonwealth Youth Games, Pune, 2008 was a test case for India hosting an international multi-sport event, as well as a preparation for international travel for our young athletes. For many of them, this was their first international trip dealing with jet-lag, travel vaccinations, potential for travellers' gastrointestinal upsets, mosquito protection, being away from home and parents, along with the requirement for medical screening examinations and anti-doping regulations. It was with this in mind that I wrote and distributed memos via the Zeus website to team members preparing them for the challenges to be faced travelling to India.

PREPARATION AND RESOURCES

Preparatory information of medical support to be available in Pune was variable. For future trips to India, publications need to be distributed to the health team leaders well in advance to allow them to make suitable preparations.

However, the really valuable information for me as a doctor was not delivered until the medical meeting in Pune two days prior to the Games starting. It included the following:

1. There is no malaria in Pune.
2. Drink (and clean teeth) with bottled water only (we knew that).
3. All village food has been prepared by an international hotel chain, meeting international hygiene and food safety standards, including salads and vegetables being washed in purified water with all appropriate food prepared on site.
4. Mosquito-bourne diseases Chikungaya and Dengue Fever were endemic in the Pune area.
5. Distribution of emergency phone numbers and contact details of key medical personnel, with the introduction of these people.
6. The anti-doping procedures and expectations were clearly explained with the accompanying booklet.

PREPARATORY TRAVEL MEMOS

Eight weeks prior to leaving New Zealand I sent a memo to all team members travelling to India, advising them to contact their doctor travel vaccination advice. Six weeks prior, I distributed a further more specific memo with travel information, along with requesting all athletes to have a Medical Screening Questionnaire and Examination performed by a New Zealand Academy of Sport designated doctor.

These memos attracted a great number of emails from athletes and parents ranging from why they needed to be done, who would pay, expenses were already high without these extra unexpected costs, questions as to the appropriateness of vaccinations and anti-malarial recommendations, too short a timeframe, no doctors available, why not their own GP, etc. I replied to all these emails explaining my rationale and reasoning, which was by and large accepted. I was acutely aware that I was to be responsible for the health and safety of 55 adolescents/minors away from their parents for the first time.

I set a return deadline of two weeks prior to leaving. Only about 35/72 of the reports were returned when asked, another 10-20 needed active chasing up and four arrived after I had left for India. Maybe two were never received. Team officials were asked to fill out their own medical information.

ANTI-MALARIALS

These were a source of debate and dilemma. I sought advice from Dr Marc Shaw from Worldwise Travellers' Health Clinic in Auckland. His advice was to advise all team members to take anti-malarial tablets, with the consensus that doxycycline was a cheap medication giving some beneficial side effects for traveller's diarrhoea and teenage acne. However, when I was advised by the local Pune medical team of the absence of malaria, I gave everyone a choice whether to stop or continue. Interestingly, most chose to continue with their doxycycline medication.

VACCINATIONS

The vast majority of team members followed recommendations for Hepatitis A, Typhoid, Tetanus, Inactivated Polio Vaccine, along with Hep B and Childhood vaccinations. A handful of people received a Rabies course. One team member chose not to be vaccinated at all, including her Childhood vaccinations.

All these vaccinations, with their initial upfront costs, will bode them well into the future, particularly for travel to the Delhi Games in 2010 and to other developing countries.

A personal **medical kit** was recommended to be packed and taken by all team members. It was recommended this should include sunscreen, anti-diarrhoeas, paracetamol, antihistamines, Gastrolyte, band-aids, sleeping pills, etc. I am unsure how many followed this request, however many times when asked the athlete would say they had these provisions. I think this is a good idea for any team travelling, as it teaches them self-reliance for team and individual travel in the future.

MEDICAL CARE DURING THE CYG

The medical team did relatively well during the CYGames. The medical facilities and support were well organized at the central Polyclinic. Prescriptions were easy to write to obtain pharmaceuticals, ambulance transport was readily available and access to diagnostic imaging was easy and readily organized. Emergency transport and access to medical consultations at the Polyclinic, and on to the tertiary hospital five to six kilometres away, were timely and easily available. The Indian medical system is based on the English model, with many of the senior doctors having trained and spent time in UK, USA, Australia and New Zealand, making communication and information sharing easy.

During this CYG we accessed the MRI scanner twice for diagnosis of a navicular stress fracture, and a shoulder injury. Both procedures were performed within one to two hours of requesting them. We also required an emergency trip to the Emergency Department for assessment of a syncopal episode to rule out a seizure-type fit and a shoulder injury. We were quickly seen by an ED specialist, a neurologist, two physicians, an orthopaedic registrar and consultant, MRI radiologist – all within four hours. Excellent priority service was given, I believe.

During the Games I had over 36 documented consultations (some more than one per person). These ranged from a full psychiatric and suicide risk assessment, viral URTIs, gastrointestinal disturbances, dermatology, sunburn, tonsillitis and musculoskeletal medicine. On top of these documented consults, there were a large number of "by the way" consults in the corridor, running things by me, particularly sore throats, change in bowels, travellers' diarrhoea. Many needed reassurance, with a recommendation of what they needed to take, what to watch out for and if not improving then to get back to me.

Due to the good quality and preparation of the food, gut upsets were mild and self limiting, many of the athletes taking care of symptoms themselves. Only one team official made me think about reaching for antibiotics for infectious diarrhoea .

Two athletes out of 55 (4%) did not reach competition day. One had a navicular stress fracture and the other a severe gastrointestinal upset on the day of competition.

Sexual activity during and after the Games was a concern and potential problem. Tackling this proactively was the best approach. Prior to leaving New Zealand it was discussed at the team managers' meeting with a consensus being reached. Prior to the team arriving, I discreetly placed over 100 condoms in the athletes' rooms (i.e. two each) with an open team talk on their arrival about their availability, including STI protection, post-exposure medication for STI and pregnancy. By the end of the trip no condoms were returned, none were used as water bombs, no further were requested and I had no consults for emergency contraception nor post-exposure STI medication. Time will tell.

Emotional support from home was important for these teenage athletes. Most had ready access to emails and mobile phones/texting. This proved invaluable for those requiring emotional support when unwell or not performing well in their sport; this kept them mentally and emotionally supported.

ANTI-DOPING TESTING

Prior to leaving New Zealand there was confusion as to how the CYG Pune Officials were going to run their first testing programme at a CYG. Unfortunately, an information booklet written in March 2008 was not distributed. Many of the youth athletes had only competed at provincial and national levels, hence had no prior knowledge about drug testing or the necessary notifications. Knowledge by the respective NSO team managers was also poor, with steep learning curves to chase up and organise athletes requiring a TUEs and TUEs.

Five New Zealand athletes were drug tested in competition, all were medallists. No "out of competition" testing was done on New Zealand team members. Delhi has only recently gained WADA laboratory accreditation, so samples were couriered overnight to Delhi with result notification within 24 hours. We had no notifications of positive results.

TRAVEL TIME

The time to travel home was long and difficult. We left Pune at 8:00am on Sunday and I arrived home at 10:00am on Wednesday. This included flying out of Mumbai at 4:00am via Delhi, spending ten hours at Singapore airport, a further eight hours at Sydney airport, and an overnight motel in Auckland. Added to this, the team was split when travelling home making it difficult for me to observe those struggling with febrile illnesses, diarrhoea, chest infections, injuries and general fatigue.

ON TOWARD DELHI 2010

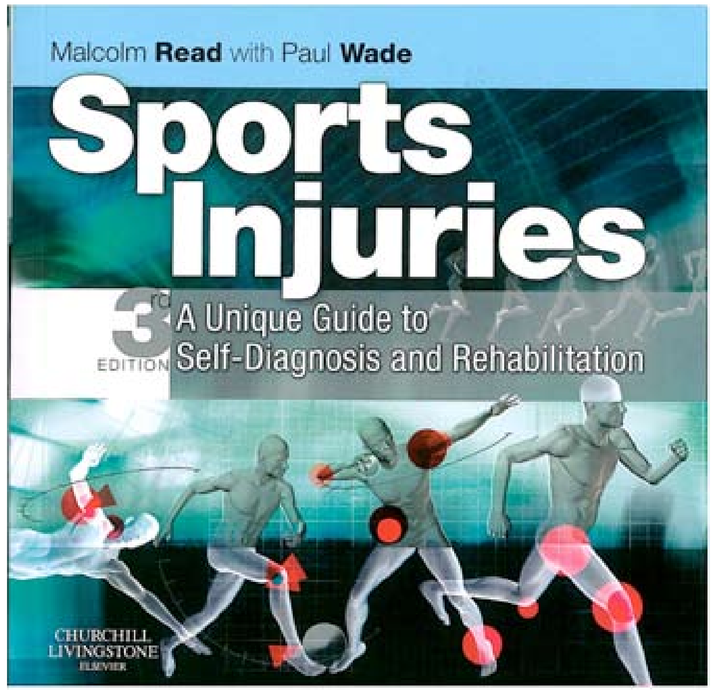
After traveling to Pune, I am optimistic for the medical services which will be provided in Delhi. The Indian doctors were well organised and fully aware of the requirements and standards expected by travelling medical teams. Many, I'm sure, have worked abroad in UK medical systems. Medical costs were not a barrier, with high-tech diagnostic imaging readily available. CYG athletes seemed to have been given priority and fast service in the private medical system provided. I cannot see that this would be any different in Delhi.

Mosquito-borne viral and parasitic diseases will always provide a medical challenge for Delhi.

Food safety and hygiene were given the highest priority in Pune, dispelling potentially a large portion of medical work due to "Delhi-belly". I wrote a congratulatory and complimentary letter to the medical organisers, as I am sure they paid due attention and priority to this. I am sure that with the success of Pune they will continue the same health and safety work in Delhi.

Sports Injuries 3rd Edition: A Unique Guide to Self-Diagnosis and Rehabilitation

Author: Dr Malcom Read with Paul Wade
Publisher: Churchill Livingston
Price: NZ $60 approximately



Malcolm Read is one of the leading lights in British sports medicine and has experience as an Olympic hockey competitor in 1968 prior to embarking on a distinguished medical career. I bought the first edition of this book soon after completing my Diploma of Sports Medicine in London in 1987. It was therefore interesting to see the way he has developed the concepts in that book and kept up with advances in diagnosis and treatment over the ensuing two decades.

The book is arranged in several sections, beginning with a chapter on injury prevention with an emphasis on static stretching and advice regarding injury kits.

The second section is an A to Z guide of commonly available treatments and their application. The majority of the book's 200-odd pages are taken up with a head to toe guide to injuries in various parts of the body. These are arranged by their anatomical location, with a succinct summary of historical and examination features plus a description of the cause and treatment.

The feature of this book that makes it stand out from the crowd is the detailed advice on self treatment that can be easily understood by the layperson. Each treatment session finishes with a brief summary of medical and physical treatment that is available for the condition, plus a general summary of the rehabilitation required. Each section is enhanced by clear diagrams emphasising the location of various pathologies and provocative tests to aide in diagnosis.

The fourth section of the book contains Dr Read's detailed rehabilitation sequences for various injuries. He calls these training ladders and they have been further developed from earlier editions of his book. If I had one quibble with the ladders it would be that they detail straight line activity very well, but there is insufficient emphasis on redeveloping cutting and turning skills with figure-8 running and then sidestepping drills. These would be most relevant for team sports players and deserve inclusion, in my view.

The final section of the book is a sport by sport guide to the various injuries characteristic of that sport and is pretty comprehensive.

So what do I think of this book? It is clearly and concisely written and well illustrated. Self diagnosis is fraught with difficulty and Dr Readhas emphasised the importance of getting professional help if an injury is not settling as expected. His book provides an excellent distillation of the British perspective on various injuries and, as such, serves as a useful counterpoint to the American perspective which tends to dominate material available on the internet.

I have a few minor quibbles, e.g. continued use of the term trochanteric bursitis rather than gluteus medius tendinopathy, which would be the pathology responsible for most lateral hip pain. Also, the Pellegrini-Stieda lesion refers to calcification at the medial collateral ligament origin, not at the adductor insertion as stated in this book. Finally, there is no real indication of the frequency of various conditions as they are seen in clinical practice. For example, patellofemoral pain is by far the commonest cause of anterior knee pain but there is no real indication of this in the text. Grouping of conditions into the common, less common and not to be missed category may be a useful innovation for future editions of this book.

Overall, I would rate this book very highly. It provides an excellent guide for the layperson and I am pleased to report that this third edition has kept pace with contemporary developments in injury diagnosis and treatment. This book should be easily available from your medical bookshop or Elsevier Australia. The website is shop.elsevier.com.au.

Chris Milne
Sports Physician
Hamilton