A Study of Patellofemoral Pain in a Junior Infantry Training Unit

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SUMMARY: The incidence of patellofemoral pain in a Junior Unit was assessed retrospectively over a 4 year period and prospectively by studying an annual intake of recruits during their initial training year. An average of 3.5% per intake were found to have been discharged due to the disease between 1977 and 1980. 4.5% of the intake prospectively studied were discharged and 75% of those presenting with symptoms were cured.

The clinical characteristics of recruits presenting with the the disorder were prospectively studied in a controlled, blind, consecutive series of 45 patients. Two groups of characteristics were identified; those with an early, insidious onset in training, a pre-Service history and a poor response to physiotherapy and those with an acute, traumatic onset, presenting later in training and responding well to physiotherapy. The aetiology of patellofemoral pain in a Junior Recruit is discussed and attention drawn to specific problems encountered by these patients.

Introduction

A comprehensive survey of the literature has shown patellofemoral pain to be a common disorder in civilian and military populations. The incidence of the disease as diagnosed at meniscectomy was found to peak in the 20 to 29 age group, becoming less frequent in later life¹. This has been demonstrated in a study on Army personnel diagnosing the disorder on a clinical basis and illustrating the severity of the problem in Her Majesty's Forces². Fulford³ in a study of naval ratings and marines has found a relationship with hard physical work, a pre-requisite of the Junior Infanter's training.

There is considerable confusion expressed in the literature^{4, 5} in the aetiology and nomenclature of pathological entities and syndromes relating to the patella. The disorders commonly presenting in the junior soldier are discussed. Relationships between the conditions are examined in the context of aetiology, pathology and presentation in a junior unit.

Chondromalacia Patellae

Chondromalacia is recognised as a well defined

syndrome of pain in the anterior part of the knee. The diagnostic reliability of the clinical presentation has been substantiated by Zollinger⁷, confirmatory diagnoses being made by arthroscopy. As described by Outerbridge⁴, there are four grades of macroscopic change of the patella cartilage in chondromalacia, ranging from softening and swelling (Grade 1) to erosion down to the bone (Grade 4). The aetiology of this condition may be explained by a ridge of cartilage on the medial femoral condyle^{8, 9} but this causative relationship has recently been refuted¹⁰. Ficat et al⁸ classify chondromalacia topographically and postulate that the location of the lesion reflects the pathophysiology and consequently the biomechanical solutions of the conditions.

Lastly, Goodfellow et al¹¹ distinguished between surface cartilage degeneration, common on the medial patella facet, associated with ageing and basal degeneration which is pathological and symptomatic. None of these classification systems of chondromalacia are mutually exclusive and each postulates an inherent, structural or biomechanical predisposition to the disorder which may be corrected surgically.

Osteoarthritis

Osteoarthritis tends to be found in older age groups¹² as diagnosed radiologically by joint space

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narrowing, sclerosis and spurring¹³. Its relevance in the junior soldier is discussed as Outerbridge¹ and others¹⁴ postulate that it and chondromalacia are manifestations of the same disease, osteoarthritis being the same as grade 4 chondromalacia. There is evidence demonstrating similar vascular changes in the two disorders¹⁵ and similarities have been found radiologically¹⁶, tending to support a common pathology. However, Abernethy et al¹⁷ and other authors^{18, 19} state that the conditions should be differentiated, chondromalacia being a transient, often non-symptomatic fibrillation of the articular cartilage. The relationship between the disorders as defined by direct access to the patella cartilage and radiology is still being debated. The arguments cause confusion in aetiology and nomenclature which are, in turn, reflected in treatment regimes, medical recording and research.

Osteochondritis

Osteochondritis, consisting of a loose osteochondral fragment may be diagnosed radiologically¹². In the junior soldier it is a relatively uncommon disorder but may present with trauma and subsequent post-traumatic osteoarthritis.

Trauma

Direct trauma to the patella is a frequent occurrence in the junior infanteer, as in skirmishing practice where it can be specifically minimised in emphasising the protection of the knees by extending the arm to take the body load on falling to the ground. Trauma and osteochondral fracture are frequent precursors of chondromalacia, 75% of cases with clinical chondromalacia patellae presenting with this history of onset²⁰. A causative association is challenged in Repo's study of the survival of articular cartilage after controlled impact²¹, where it is noted that a purely compressive impact as in the "dashboard injury" presenting a femoral fracture, does not cause cartilage damage.

Over-use Syndrome

Over-use syndrome in young athletes may be classified as a separate entity¹², microchondral fractures of the patella being postulated as a pathology in these cases²². This may be a cause of confusion as chondromalacia patella is seen as a clinical presentation in this population^{2, 3, 23}. In the context of the Army where physical fitness is encouraged²⁴ the relationship between trauma, over-use syndromes and chondromalacia become difficult to unravel either clinically or surgically.

Quadriceps Dysplasia and Mal-alignment Syndrome

The patella-mal-alignment syndrome, resulting in lateral patella tracking²⁵ and excessive lateral pressure

syndrome²⁶ may well cause chondromalacia patella and recurrent subluxation. The two entities being manifestations of the same disease²⁷. The mal-alignment syndrome may be a direct result of quadriceps dysplasia²⁸ and is associated with a high riding patella²⁰. Williams²⁵ emphasises the role of vastus medialis and quadriceps reversal in the aetiology of chondromalacia patella and developing this, Reider et al²⁹ suggests that subluxation dislocation and chondromalacia should be re-designated as quadriceps dysplasia; one, two and three. There is no doubt that quadriceps pathology plays an integral role in chondromalacia patella and consequently rest and physiotherapy play a crucial role in the initial management of the disease^{6, 12, 14}.

Other conditions¹² which may present as patello-femoral pain in the young soldier and athlete include peri-patella epiphysitis, tendonitis and rarely sympathetic dystrophy which may be diagnosed radiologically²⁶.

It is evident from this brief review that the concept of single pathology, patello-femoral pain should be viewed with some suspicion. The relationships between chondromalacia, osteoarthritis the over-use syndrome, trauma, mal-alignment and quadriceps disorders are profoundly complex, resulting in confusion of nomenclature and difficulties in assessing the role of each in the presentation of the junior soldier with patello-femoral pain. Non-surgical management of junior soldiers presenting with patello-femoral pain will not always be appropriate. This study is designed to demonstrate the incidence of the syndrome in junior training unit and identify the clinical presentation of those patients who will need surgical investigation and treatment.

Materials and Methods

Population: The study population consisted of junior soldiers, 16 years old, recruited nationwide and all taking part in a pre-structured military training programme of 12 months duration. Each patient was asymptomatic and passed medically fit by two independent medical examinations at initial recruitment.

Retrospective Study: The incidence of patello-femoral disease as a cause of medical discharge from the Unit between 1977 and 1980 was determined retrospectively. The medical records pertaining to medical discharges due to the condition as diagnosed by the Unit Medical Officer and confirmed by a Specialist were identified. The number of recruits in each intake during this period were recorded and the percentage discharge per intake calculated.

Prospective Studies: A more detailed prospective study of the extent of the disease current in at Battalion was carried out. The study followed 500 re-

recruits through the initial year of training. Soldier's personal details and training progress were recorded, as were the recruits' medical management and final disposal, if presenting with patellofemoral disease. The incidence of the clinical disease, cure rates and referral rates were recorded from each Company in the Battalion.

Following a pilot study a prospective, double blind study was carried out, its aim to identify the clinical sub-groups presenting with patello-femoral pain. A consecutive series of 45 recruits presenting with the syndrome and a random control sample of 50 recruits were studied. Details of symptoms, mode of onset and representative support, pre-enlistment and during training were documented in both groups. Treatment and outcome were recorded under double blind conditions.

In both prospective studies patellofemoral pain was diagnosed on clinical grounds as expressed in the literature,⁹ diagnostic signs were:

- Pain induced on extension of knee against resistance.
- Pain on gentle manipulation of patella over the femoral condyles and resistance of this movement.
- Condyles and resistance of this movement.
- The patella apprehension test (positive).
- Pain on quadriceps contraction against mild, distally directed pressure on the patella.

Symptoms diagnostic of pre-service and service disease were:

- Pain on stair walking³⁰.
- Pain or stiffness associated with rest and after sport⁶.
- History of dislocation of the patella¹³.
- Feeling of giving way or instability of the knee¹⁴.

Only if a recruit was unable to run 50 metres and failed to maintain peer group standards of training was he included in the study group as a sufferer of patellofemoral pain.

Treatment was standardised; each patient attended physiotherapy for one hour each weekday for a five-week pre-structured physiotherapy regime similar to that advocated by Williams,³¹ consisting of radiant heat and rest, progressive quadriceps faradism and isometric quadriceps extension exercise. Two grams of soluble aspirin were taken daily by each patient in divided doses.^{32,33} All other activity was curtailed apart from swimming in the fourth and fifth week.

Cure was defined as the absence of signs and symptoms over a minimum of two months of strenuous physical training and a series of combat fitness tests.

Contingency tables were used in statistical analysis.

shown in Table 1. The percentages are of the total intake of recruits, there is an immediate 30-50 per

Results

Incidence: The incidence of patellofemoral disease as a cause of discharge between 1977 and 1980 are cent discharge of recruits due to homesickness and personal reasons in the first month of training.

Table I
Information from unit and personal records

Month of intake	No of recruits on intake	Nos of discharges due to P-F pain	% Discharged
June 1977	129	2	1.50
Sept 1977	598	7	1.17
June 1978	220	6	2.72
Sept 1978	533	6	1.13
Mar 1979			
June 1979	279	6	2.15
Sept 1979	440	22	5.00
Mar 1980	51	3	5.80
June 1980	233	17	7.62
Sept 1980	526	16	3.00

The results of the prospective study of 500 recruits are shown in Table II. The percentages have been adjusted in this case to accommodate other causes of discharge and consequently illustrate the percentage of recruits failing to pass adult service because patellofemoral disease alone.

Table II
Outcome and presentation percentages of recruits suffering from Patello-Femoral disease from an intake of 500 junior soldiers

Company	1	2	3	4	5	Battalion
% of company presenting	21.5	25.8	15.3	15.4	18.0	18.8
% of patients cured	64.0	93.7	60.0	69.0	84.0	75.0
% of company uncured	7.6	1.38	6.1	4.7	2.7	4.5

Percentages have been adjusted to allow for other causes for discharge

We were particularly aware of the possibility of recruits presenting with symptoms or over emphasising their disorder to avoid unpleasant or arduous tasks in training. (A common occurrence in a junior training battalion.) In order to examine this hypothesis the Company percentage cure rates were plotted against the Company percentage presentation rates; a non significant correlation of 66 % was found. When the Company percentage discharge was plotted against the percentage presentation rate, a negative correlation of 41.3 % was found, again non significant.

Clinical Characteristics: The prospective study of 45 recruits and control group demonstrated that none of the control group were found to have a pre-service history of patellofemoral pain, while 28% of those with a service attack did. ($p<0.01$). If a recruit had played pre-service sport he was less likely to present with patellofemoral pain during the year of initial training (65%) then if he had not played pre-service sport (77%). This result is just significant at the 5% level.

The results of the study of the consecutive series of 45 recruits presenting with patellofemoral pain demonstrated three main determinants of clinical profile:

1. The mode of onset; acute and traumatic or insidious and progressive with no noticeable preceding trauma.
2. Pre-service history of symptoms of patellofemoral disease.
3. The response of symptoms and signs of physiotherapy.

These are illustrated in Table III.

A more detailed analysis of these results demonstrates that the two numerically predominant groups in the table are statistically significant. Recruits with a pre-service history are less likely to be cured than those without. ($p<0.001$) Recruits with a pre-service history are more likely to have an insidious onset whereas those without are more likely to have an acute traumatic onset. ($p<0.001$) An initial, acute onset of symptoms (whether service or pre-service) is more likely to be cured than those with an insidious onset. ($p<0.001$) More specifically, those with no pre-service history and an acute onset are more likely to be cured than those with an insidious onset. ($p<0.05$) The lack of patients with an insidious onset and no pre-service history makes this less reliable, this is significant in itself.

Table III

Therapeutic outcome related to pre-service history and mode of onset of Patello-Femoral pain

		Cured	Uncured
Preservice history experienced	Acute traumatic onset	3	1
	Insidious onset	2	10
No preservice history	Acute traumatic onset	22	2
	Insidious onset	2	3

An unavoidable variant in the treatment regime was a random insertion of three weeks leave. During the leave period rest was encouraged, medication continued and physiotherapy stopped. Forty two per cent of cases where the patient went on leave during treatment were cured, whilst 92% of those not

going on leave were cured. The difference is statistically significant ($p. 05$).

The two main groups of clinical presentation were plotted against the time of onset in relation to the year's training. Figures 1 and 2 demonstrate that the majority of those with a pre-service history, insidious onset and failure to respond to physiotherapy presented earlier in their training. Those with a traumatic, acute onset and no pre-service history presented nearer the end of their training.

Conclusion

The aims of this study are threefold; to demonstrate the incidence of patellofemoral pain in a Junior Infantry Training Unit, to identify the clinical characteristics of the syndrome and to draw attention to the specific problems facing a symptomatic soldier in the context of his training and management.

The retrospective study of medical discharge due to the condition was hampered by incomplete medical records. Consequently the average (approximate) 3.5% discharge of each intake is likely to be an underestimate. The medical documents of 1977 and 1978 were particularly incomplete as reflected in the figures. The prospective assessment of disease incidence is more informative: in the year studied

Fig. 1 % of recruits presenting in each month

- Group of pre-service history, insidious onset, not cured
- Group of no pre-service history, acute onset cured

% IN EACH MONTH

Fig. 2 % of recruits presenting in each month in each group.

18.8% of potential adult soldiers presented with the syndrome. Of these 75% were cured by physiotherapy, the remainder eventually being discharged after specialist consultation and treatment. These represented 4.5% of the study group.

In examining the characteristics of the syndrome two clinical sub-groups were identified: firstly, those presenting early in training with a pre-service history, insidious onset, failure to respond to physiotherapy and eventual discharge. Secondly, those presenting later in the year with no pre-service history, acute, trauma related onset and a good response to physiotherapy. We postulate that those in the first group have an inherent tendency to present with patellofemoral pain as has been shown in the case of chondromalacia and subluxation of the patella.³⁴ This tendency was clinically manifest pre-service and re-presents on commencement of Army training. Those in the acute onset group do not have the same tendency to patellofemoral disease and present later in training, following trauma, when physical fitness and field training are of high priority. As they do not have a premorbid biomechanical or structural abnormality they respond to conservative treatment and tend not to re-present.

This hypothesis is supported by two further clinical findings: firstly, a recruit is more likely to develop

service patellofemoral pains if he has a pre-service history. ($P < 0.01$). Secondly, if a recruit played pre-service representative sport he is less likely to present with patellofemoral pain in service. (Significant at the 5% level). The relevance of this can be explained by those with a syndrome predisposition and a pre-service history are less likely to expose themselves to the trauma of sport. Our study was too small to validate this hypothesis statistically.

We have demonstrated two distinct groups of junior soldiers presenting with patellofemoral pain. Two variables which were considered relevant in determining the clinical profile of the syndrome were examined: firstly, there was a random interruption of the physiotherapy course by three weeks vacation in some cases. Recruits for whom the treatment was interrupted were less likely to be cured than those who had an uninterrupted course. This would suggest that active physiotherapy as we have described it may play an important role in the treatment of the syndrome. Secondly, it was postulated that recruits were exaggerating symptoms in order to avoid duties. A tendency for company cure rates to increase as presentation rate increased was demonstrated. This might be expected if one assumed a constant rate of disease across all companies with some personnel exaggerating symptoms and eventually being "cured." A constant discharge rate, irrespective of presentation rate would be expected. This was not the case, a negative correlation was demonstrated. Neither of these correlations are statistically significant but what trends there are suggest the hypothesis is false and that other factors determine the presentation, discharge and cure rates of the company.

This study has demonstrated that patellofemoral pain is a major clinical entity in this junior unit. A number of pathologies present as the syndrome but those recruits that are going to be discharged as a result of the condition can be identified by clinical examination and careful history taking. As demonstrated in the recruits, this insidious onset group represents 25% of cases in civilian life.²⁸ It is evident that the medical screening system for recruit selection is inadequate. As the diagnosis is primarily a clinical one, a case can be made for increased teaching emphasis of future Unit Medical Officers and those involved in recruitment medical examinations with particular reference on the significance of pre-service symptoms.

The junior soldier, not responding to physiotherapy on the specialist waiting list, or waiting for medical board proceedings, presents a problem for the unit. During the study it was a common occurrence for this waiting period to be greater than three months. The main causes of delay were the waiting list and procedural delays in discharge. A considerable output in finance and man hours were spent in supporting these

redundant soldiers, a fall in their individual and peer morale was evident. Necessarily the recruit's family has to readapt and reorganise home life to accommodate a returning boy. A new occupation must be sought with the added handicapping label of an Army Medical Discharge.

It is evident that our screening systems are faulty and that a reassessment of the priority for a junior recruit with this pre-service disease should be made if these problems are to be resolved.

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