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The influence of the Covid pandemic on the epidemiology of Achilles tendon ruptures in east Shropshire, United Kingdom.

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Abstract:

Objectives: Management strategies of the Covid pandemic included isolation to prevent transmission. This study aimed to determine if the pandemic of 2020 influenced the epidemiology of Achilles Tendon Rupture (ATR).

Methods: The demographics of presentations from the local population to xxx hospital, Shropshire, United Kingdom with an ATR were analysed and compared together with the season, month, and year of the injury.

Results: From 2009 to 2019 there was no significant change in the incidence of ATR over time with mean (SD) incidence of 13.3 per 100,000. In 2020, there was a decrease in injuries with an incidence of 8.4 per 100,000, with an increase in 2021 to 22.4 per 100,000. In 2021, there was an increase in injuries from March with numbers maintained until October.

The most common activity of ATR was Team sport (36.2%), followed by Activities of Daily Living (28.9%), Other physical activities (21.0%) and Racket sports (13.9%). In 2020 there was the lowest number of injuries sustained in Team and Racket sports, however in 2021 they accounted for over half of Injuries.

Conclusions: There were significantly more patients sustaining ATR in 2021, the year after the covid pandemic and mandatory isolation. This was considered to be related to altered activity and Team and Racket sports during 2020.

Levels of evidence: IV Case series

Key words: Epidemiology, Achilles tendon, rupture, Covid pandemic.

What is already known:

- Achilles tendon ruptures commonly occur during sport and exercise activity.
- Ruptures typically occur with the resumption of unaccustomed activity.
What are the new findings:

During the year of the covid pandemic there was a decrease in injuries with an incidence of 8.4 per 100,000, with an increase to 22.4 per 100,000 the subsequent year. In 2020 there was the lowest number of injuries sustained in Team and Racket sports, however in 2021 they accounted for over half of Injuries.

1. Introduction:

Patients sustaining an Achilles tendon rupture (ATR) are typically in their mid to late 40s and tend to sustain ruptures during sports activity [1–3]. In North America, Korea and Scandinavia the incidence of ATR is increasing [4–12] at increasing rates of 2.4% per year for the last 30 years [13]. However, in other series from Denmark and Japan, no change in the incidence is reported over the last two decades [14,15]. The increase in incidence of rupture, greatest in those over 60 years of age [7] was thought to be due to increased numbers of older patients taking part in sports activity [14] however in Ho et al's [16] meta-analysis no correlation with over time was noted for those who sustained a rupture during athletic activity.

The predominant sport during which Injuries were sustained varies between countries [1,3,12,17], but commonly involve competitive team sports such as football [1] or basketball [6,18], or racket sports e.g. badminton [19,20] and squash. The seasonal variation in ruptures differs with some studies reporting increased ATR in the spring and summer [17,18,21,22] and others the autumn and winter [14,20]. High incidences in the autumn and winter from Scandinavia are thought to reflect the increased amount of high-risk sporting activity occurring indoors during seasons with little daylight [20].

The pandemic caused by the SARS-COV 2 virus started during the spring of 2020. The majority of countries adopted measures to minimise spread to protect the population from infection and reduce the impact on healthcare services [23]. This involved the wearing of face masks, use of sanitizing hand gel and isolation into household groups. Social isolation was enforced in many countries with non-essential work activity stopped and the cessation of team sports activity [24]. The resumption of sports activity following a period of lack of participation was noted by
Simmonds as factor for ATR[25]. Following the 2011 NFL Lockout lasting five months, 10 ATRs occurred during the first 10 days of training camps and two further ruptures pre-season[26].

The aim of this study was to estimate the incidence of ATR per year over time and to determine any variation over the calendar year and to see if the lockdowns of the covid pandemic were associated with a change in the epidemiology of ATR. Secondary aims were to determine if there was any variation in the mechanism of rupture in older patients sustaining ATR.

2. Methods:

From February 2009 patients presenting to the XX Hospital in East Shropshire and diagnosed with an Achilles tendon rupture were collated in a database. The Research and Innovation Department of the XX Hospital National Health Service (NHS) Trust deemed this research to be service evaluation and ethical approval was not required. Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. From NHS England, the local population served by XXH was estimated to be 250,000, living in a mixture of urban and rural areas[27].

Diagnosis of Achilles tendon rupture was made on the history of a pop to the Achilles tendon with a subsequent inability to perform walking with a single heel-rise. Tendon discontinuity on examination was indicated by a palpable gap to the Achilles tendon for mid-substance tears, an absence of ankle plantar flexion on manually squeezing the calf muscle and increased ankle dorsiflexion resting position, termed the Achilles Tendon Resting Angle (ATRA)[1,28]: Patients with acute, chronic, mid-substance, distal and musculotendinous ATR were all included.

Tears at the musculotendinous junction were diagnosed with a history consistent with rupture, an increased ATRA and calf circumference compared with the non-injured side and tenderness at the rupture site[25,29]. A palpable gap may or may not be present at the rupture site. A muscle-tendon junction tear was confirmed by ultrasonography performed by a Musculoskeletal Radiologist.
Chronic ATR were diagnosed using the same features and the patient was unable to perform a single heel rise. Increased ankle dorsiflexion and reduced push off during gait may also be noted. Imaging was also used to identify tendon end separation with chronic ATR. Patient interview determined the likely date of rupture.

The dates on which ruptures occurred were categorised according to the northern hemisphere seasons: Spring 1st March until the 31st May, Summer 1st June to 31st August, Autumn 1st September to 30th November, Winter 1st December to 28th February. The activities during which the rupture occurred were defined as Team sports e.g. football, netball, basketball, cricket, field hockey, Racket sports usually played on a court e.g. badminton, tennis. Other physical activities usually did not have a competitive element and included attending a gym for fitness e.g. classes and weight training, farm activities such as tending to sheep, forestry and finally Activities of Daily Living included walking, climbing stairs/steps, pushing cars, dancing, playing with children.

The dates of national lockdowns were determined from a United Kingdom (UK) government website[24]. In the UK, three national lockdowns were implemented. The first commenced on the 26th March 2020 with outdoor recreation permitted on the 13th May. The second the 5th November with a gradual easing from the 25th December. Finally, the third commenced on the 6th January 2021 with release of restrictions on the 8th March and group indoor gym exercises commencing on the 17th May.

Analysis: Data was collated on a spreadsheet (Excel, Microsoft, Redmond, WA). The numbers of patients injured per month was noted over time. Non-parametric data was presented according to median (Inter-quartile Range (IQR)). Patients who sustained subsequent contralateral rupture were included for each rupture of the Achilles tendon. Patients who sustained a re-rupture of the Achilles tendon were included for the first rupture only. Statistical analysis (SPSS Version 28 IBM Corp, Armonk, NY) was performed using Crosstabs and Chi-squared using additional layers for Activity and Age groupings. Significance was taken to be p < 0.05.

3. Results:
From February 2009 to August 2022, 436 patients sustained a rupture of the Achilles tendon. The mean (SD) age was 48 (14) years with the majority of patients peaking in the mid 40s and a second smaller peak in the late 60s (Figure 1). The ratio of males to females was 5:1.

Figure 1: The frequency (n) of the age of patients at presentation with ATR from 2009-2022.

For the years 2009 to 2019 there was no significant change in the incidence of Achilles tendon rupture over time with mean (SD) incidence of 13.3 per 100,000. In 2020, there was a decrease in injuries with an incidence of 8.4 per 100,000, followed by an increase in 2021 to 22.4 per 100,000 (Figure 2).

Figure 2: The number of patients presenting per year with ATR, noting the pandemic in 2020 and an increase in presentations in 2021.

Figure 3: The number of injuries sustained per season from 2009-2021. Over half of presentations occurred in the spring and summer seasons in most years.

Figure 4: The variation in Achilles Tendon Rupture over the year. The median line represents the median number (IQR) of ATR occurring per month for the years 2009-2019, together with presentations per month in the years 2020, 2021 and 2022. Release from the third lockdown occurred at the end of March 2021.

Overall, most injuries occurred during the summer (32.0%), then spring (25.4%) and autumn (23.2%), with least injuries during the winter (19.3%). Over half of presentations occurred in the spring and summer seasons in most years with a peak during May, June and July, the late spring and early summer (Figures 3 & 4). When ATRs were compared per month, ruptures in 2020 occurred mainly within the median interquartile range with the exception of a peak in April. In 2020, monthly rupture rate fell below the IQR during the summer month of July and there was an increase in injuries in September. In 2021 there was an increase in injuries
from March with numbers maintained above the IQR until October. In the first half of 2022 the number of injuries returned to within the IQR (Figure 4).

Figure 5: The numbers of patients with Achilles Tendon Rupture <65 and ≥ 65 years of age over time.

In terms of age, there was a gradual increase in numbers of patients with ATR aged 65 years and over time from 2009-2019. The numbers aged 65 years and over did not decrease in 2020 (5.1%) or increase in 2021 (13.5%) (Figure 5).

Between 2009-2022 the most common activity of injury was Team sport (36.2%), then injuries sustained during ADL (28.9%), Other physical activities (21.0%) and racket sports (13.9%). It was most common for injuries to occur in competitive team sports, however in 2014, 2017, 2018, and 2020 most injuries were sustained in ADL and Other activities. In 2021 following the release of lockdown, Team and Racket sports accounted for over half of Injuries (Figure 6).

Figure 6: Activities during which Achilles Tendon Ruptures were sustained from 2009-2021.

From 2009-2019 there was no significant change with time for activity (p=0.48), age (p=0.06), or gender(p=0.435). However, there was a significant difference with more ATRs presenting in the months: May 14.3%, June 9.7% and July 12.5% (p=0.014) however for seasonal distribution according to the dates used there was no significant difference (p=0.13)). When activity and age were compared over this time period there was no significant difference neither in the <65 (p=0.79) nor in the >65 (p=0.719) age groups.

For the years 2009-2021, there was also no significant difference between the activity (p=0.233), age (p=0.052) or gender (p=0.286). Similar to the earlier period, there was a significant difference with more ATRs presenting in the months: May 13.9%, June 10.3% and
July 11.7% (p=0.044) however for seasonal distribution according to the dates used there was no significant difference (p=0.171)). When activity and age were compared, there were significant differences between age groups, with more ruptures occurring during Team (45.7%) and Racket sports (10.9%) in the <65 years age group (p=0.038) compared with the >65 years age group (p=0.882), where the predominant injurious activity was ADL 57.1%.

4. Discussion:

The most important finding of this study was that there were significantly more patients sustaining ATR in 2021, the year after the covid pandemic. More specifically there was also a sudden increase in ATR in April 2021 and this peak continued over the subsequent 6 months. The peak in injury during the spring of 2021 coincided with the release of a lockdown in the UK at the end of March 2021.

During 2020, there was a lower number of overall ATR, and particularly in those related to Team and Racket sports, however this was similar to numbers experienced in 2018. This was similar to a pattern of presentations reported at a US Orthopaedic clinic with 24 ruptures presenting in 2019 and 3 ruptures in 2020 (p=0.019)[30] The lower number of ATR would be expected since there was no competitive team sport or racket sport participation during this period within the UK. There was also no change in numbers of ATR in the older age group patients or ruptures sustained during ADL and Other activities. This would again be expected as ADLs continued, and many people adopted Other new exercise activities to which they were unaccustomed such as on-line exercise activity[31]. These unaccustomed activities may have placed them at increased risk of ATR. This was again similar to the epidemiology reported at hospitals in the United States[33]. These new activities were virtual gym for classes just performed in isolation which were categorised as Other in this study. There was a small, but not significant, increase in the number of competitive sports activities following the lifting of separate lockdown exercise restrictions during the autumn of 2021 year.

In 2021, there was an increase in the overall number of ATR. The largest increase occurred following the release of the last lockdown on the 8th March and also coincided with
the peak in ruptures during the spring and summer from 2009-2019. The size of this peak was larger than any other year suggesting that the resumption of activity following the lockdown may have been a factor. Altered tendon loading activity during the preceding year may have influenced the biomechanical characteristics of patient’s tendons increasing the susceptibility to rupture. Despite an exercise programme during covid related lockdown, professional football players were found to have higher body fat percentage but an increased lower body strength.[34] The general population however undertook a 31% reduction in physical activity also increased BMI during lockdown world-wide[35]. It is possible that there was greater participation in competitive Team sports following the release of Team sport restrictions after these sports had not been available during the previous year, however the proportion of ruptures occurring during this activity, did not increase compared with previous years.

During the first half of 2022, injuries returned towards the pre-covid pattern with numbers of rupture per month falling towards the IQR and a spike in incidence during the early spring.

The effects of a rapid resumption of loading activity can have a dramatic effect on the incidence of ATR. In 2011, NFL players were unable to participate in the usual 14-week pre-season preparations, a period termed “The NFL lockout”. After the lockout, players undertook a training camp and rapidly returned to competition over 17 days. Ten ATRs occurred during the first 12 days and a further two over the next 17 days of competition[26]. During 2020 and 2021, care, specifically due to the covid pandemic, was taken to avoid such injury in basketball and gymnastics in addition to concerns over returning to exercise following covid infection and measures to mitigate virus spread[36,37].

The incidence of ruptures prior to 2020 in our locality remained steady, similar to studies reporting incidences in Denmark and Japan[14,15]. There was however a gradual increase in numbers of patients with ATR aged 65 years and over with time. This is similar to others studies from Korea, North America and Scandinavia [4,6–12,14,18,20] in which a gradual overall increase in the number of ruptures was reported, but with the greatest increase in elderly patients. This increase in the elderly was attributed increased participation in sporting
activity. In this study the numbers sustaining ATR aged 65 years and over did not significantly
decrease in 2020 or significantly increase in 2021. There was no significant increase in the
numbers of >65 years sustaining a rupture in any specific sport activities from 2009-2021 and
ruptures were most commonly sustained during ADLs in this age group.

Limitations of this study are that, in common with other epidemiological studies, it must
be appreciated that the overall population cannot be counted and the value is an estimation.
Similarly, it is possible that some patients may not have presented to XXX following their
rupture. These include those who attended private healthcare providers, however in the
locality of the study this is unlikely. During the 2020 pandemic year local private practice was
not available with all hospital services being provided for the public healthcare. In 2021, local
private practice resumed and theoretically patients with ruptures could have been lost to
collection via this route. Additionally, a small number of patients may have sustained a rupture
and not yet presented due to a delay in recognition. The loss of patients would result in the
recorded incidence in 2021 being an under-estimation. Further limitations include that some
patients sustaining rupture may have been missed due to a lack of referral to the first author’s
practice in 2009. This may explain the relatively low number of ATRs in that year compared with
the subsequent years.

An additional consideration of this study might be related to the categorisation of
different activities during which injury occurred. Participation in competitive Team sports e.g.
football, netball, and Racket sports is clear. Activities of Daily Living included walking, walking
on stairs and dancing. Going to the gym for exercise or a work out covers a range of activities of
different intensity, as does running and so these were categorised as Other. Similarly, Other
was used as the category for ATR sustained during rural activities involving farm vehicles and
animals. A decrease in the proportion of ATR sustained during ADL in the older age groups in
this study, would suggest as increase in activity participation in the older patients but would not
be a direct cause and effect.

The principal long-term effects of the SARS-CoV-2 virus are related to the heart, lungs
and brain however long-term fatigue and reduced activity may occur[36]. Patients were not
specifically asked whether they had been infected with the virus. It is possible that the increase
in ATR could have been influenced by the direct or indirect effect of virus infection rather than altered activity related to lockdown. Many patients may have had virus, however been relatively asymptomatic.

During the year 2021 there was a significant increase in ATR potentially associated with changes in activity during the preceding year. Participation in sport and physical activity may return to previous patterns over the year ahead however the effect of these changes on ATR are yet to be fully appreciated.

5. Conclusions:

There were significantly more patients sustaining ATR in 2021 the year after the covid pandemic and mandatory home isolation in east Shropshire in the UK. This was considered to be related to altered activity and competitive team and racket sports during 2020. The peak in injury during the spring of 2021 coincided with the release of a lockdown at the end of March 2021 in the United Kingdom.

Competing interests-MRC can confirm, on behalf of all the authors, that there are no competing interests.

Contributorship- MRC devised the study, collected the data and co-wrote the paper. FM & KF assisted with data analysis and technical aspects of the paper writing. CH, AB and KNH assisted with data analysis and co-wrote the paper.

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Ethical approval information- This study has been deemed to be service evaluation.

Data sharing statement- Data are available upon reasonable request

Patient involvement- Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.
References:


Frequency (n) of patient ages at presentation with Achilles Tendon Rupture
The number of patients presenting with ATR over time

Frequency

Year

Declaration of interests

☐ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☒ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Michael Carmont reports financial support was provided by British Orthopaedic Foot and Ankle Society.
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