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Original article

Does hip or knee joint replacement decrease chances to complete an ultra-trail race? Study in participants at the Ultra-Trail du Mont Blanc®.

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Abstract

Introduction. – The number of patients with hip or knee joint replacements is increasing. Some of these patients want to practice sport, including in high-impact sports such as ultra-trails. Is the proportion of drop-out higher among runners after a hip or knee replacement? What are the symptoms of these patients?

Hypothesis. – Hip or knee joint replacements are associated with a higher drop-out rate during an ultra-trail.

Material and methods. – We conducted a monocentric retrospective epidemiological study. A questionnaire translated into French, English and Spanish were sent to all runners registered for one or more of the 5 races of the 2015 to 2017 Ultra-Trail du Mont-Blanc® (UTMB®) editions. There were no exclusion criteria. The drop-out rate of patients who responded to the questionnaire was calculated among patients with and

without hip or knee joint replacement. Specific symptoms related to these joint replacements were identified before, during and after the race.

Results. -- Out of the 24,855 participants having run at least one of the 3 editions, 2,469 responded. Some of them ran several races: these 2,469 runners were on 3,171 start lines and 2,548 finish lines (drop-out rate of 19.6%). Among these 2,469 runners, 18 had hip and/or knee replacement and were on 27 start lines and 17 finish lines (drop-out rate of 37%).

The race was finished by 3 of the 6 runners with a total hip arthroplasty (THA), all of the 8 runners with a hip resurfacing arthroplasty (HRA) and 3 of the 4 runners with a total knee arthroplasty (TKA). Among runners with THA, pubalgia or groin pain was described by one of them before the race, 3 during the race and 2 after the race. Among runners with HRA, pygalgia or groin pain was described by 2 of them during the race. As for the TKA, there was no specific symptom. No answering runner had a unicompartmental knee prosthesis.

Discussion. – Running ultra-trail is possible after a hip or knee joint replacement. All of the 8 runners with HRA finished the race. We may remain cautious about the long-term survival of prostheses.

Level of proof: IV; Monocentric retrospective epidemiological study

Keywords: Sports; Running; Athletic Injuries; Arthroplasty; Hip Replacement; Arthroplasty; Knee Replacement; Biomechanical Phenomena

1. Introduction

In France, 10 million people have osteoarthritis: 3% before 45 years old, 65% after 65 years old and 80% of people after 80 years old [1]; in 2016, about 150,000 total hip arthroplasties (THA) and 80,000 total knee arthroplasties (TKA) were implanted. These numbers are constantly increasing, mainly due to the ageing of the population and the increasing prevalence of obesity [2,3]. These patients strongly desire to remain active and/or to resume a satisfactory level of physical activity or even competitive sports [4]. The issue of resuming sport after a hip or knee joint replacement has therefore been the subject of a number of studies since the 2000s, showing a variable compatibility between moderate intensity sport with light to medium impact and a total hip arthroplasty (THA) [4–21], a hip resurfacing arthroplasty (HRA) [5,9,11,13–15,22–25], a total knee arthroplasty (TKA) [4,5,7,8,10,11,13,15,16,18,21,26–28] or a unicompartmental knee arthroplasty (UKA) [5,8,11,13,15,29].

In high-impact sports (such as running), only a few studies have been carried out recently in patients with a hip or knee joint replacement [30–36]. The conclusions were cautious but encouraging as to the compatibility of high-impact sports practice with short-term follow-up. There are few data available in ultra-trail sports, or on the long-term follow-up of athletes who have had a hip or knee joint replacement. However, some patients with a joint replacement run in the Ultra-Trail du Mont-Blanc® (UTMB®). We hypothesized that joint replacements were associated with a high drop-out rate during an ultra-trail. Specific complications or symptoms related to joint replacement were analyzed before, during and after the race.

2. Material and methods

2.1. Patients and study design

According to the International Trail Running Association (ITRA) and the French Athletics Federation (FFA), a trail is a race with classification and/or time recording, taking place in a natural environment, in self-sufficiency or semi-sufficiency (with

supplies), on paths with the minimum number of asphalt roads. Trails can be divided into 3 race formats according to distance and altitude: short distance trail (less than 42 km), trail (42 to 80-100 km) and ultra-trail (more than 80 km according to the FFA and 100 km according to the ITRA, with more than 2,000 meters of altitude difference). The total asphalt surfaces do not exceed 25% in short distance trails and 15% in trails or ultra-trails. UTMB® is a worldwide trail running event taking place around the Mont Blanc Massif. There are 5 races: Orsières-Champex-Chamonix (OCC), 55 km with a positive altitude difference of 3,500 meters; Courmayeur-Champex-Chamonix (CCC), 101 km with a positive altitude difference of 6,100 meters; Sur les traces des Ducs de Savoie (On the footpath of the Dukes of Savoy, TDS), 121 km with a positive altitude difference of 7,300 meters; Ultra-Trail du Mont-Blanc (UTMB), 170 km with a positive altitude difference of 10,000 meters and La Petite Trotte à Léon (Little trot of Leon, PTL), 300 km with a positive altitude difference of 25,000 meters.

Between 2015 and 2017, 24,855 runners were registered for one of the five UTMB® races: 4,420 for the OCC (55 km), 6,401 for the CCC (101 km), 5,419 for the TDS (121 km), 7,715 for the UTMB (170 km) and 900 for the PTL (300 km). Of the 24,855 runners registered, 7,580 dropped out (30.5%) and 17,275 finished (69.5%). Some of them participated in several editions [37].

We conducted a retrospective cross-sectional study for all runners involved in at least one of the five UTMB® races between 2015 and 2017.

2.2. Methods

An online questionnaire of 27 questions, translated in French, English and Spanish, was sent by the UTMB® Medical Commission in October 2017 by email. Two reminders were sent in November and December 2017. The completed questionnaires had no missing data (all questions had required answers before being sent) (appendix 1). The questionnaire analyzed the sociodemographic data, the presence of a hip or knee joint replacement, the occurrence of complications or symptoms before, during and after the race and the status during the race (finisher or not). The responses were forwarded to the investigators in December 2017, then

anonymized and processed in January 2018. We obtained agreement from the *Commission Nationale de l'Informatique et des Libertés* (CNIL) (N°2141805v0). There were no exclusion criteria.

2.3. Methods of assessment

The compatibility of ultra-trail practice with hip or knee joint replacement was assessed by the drop-out: thus, our primary judgement criterion assessed the influence of the arthroplasty on sporting performance by analyzing whether the runners had succeeded in finishing the race or not (regardless of the reason for dropping-out). The distance run before the drop-out was not known. The drop-out rate was calculated for all the runners and for the runners with joint replacement.

Symptoms or complications related to joint replacement were identified before, during and after the race (the time of occurrence of these symptoms was left to the discretion of the runner responding to the questionnaire). Aspecific symptoms were also asked in the joint replacement and control groups.

2.4. Statistical analysis

The quantitative variables were described by their means and standard deviations. The qualitative variables were described by their numbers (N) and percentages. The results were described in terms of runners and not in terms of joint replacement (one runner could have had several joint replacements).

There were no missing data among the sent questionnaires (the questionnaires could not be incomplete before validation). The results were analyzed on RStudio 0.98.

The level of proof for this monocentric retrospective epidemiological study is IV.

3. Results

Drop-out rate

In our study, 2,469 runners answered the questionnaire (Figure 1).

The respondents had run a mean number of 1.8 races over the 3-year period. Thus, these 2,469 runners represented 4,332 registrations (17.4% of the total 24,855 registrations over the period). Of the 4,332 runners registered, 1,161 dropped-out before the race (26.8%); among the 3,171 runners on start line, 623 dropped out during the race (19.6%) and 2,548 finished (80.4%) (Table 1). In total, of the 2,469 runners who were registered at 4,332 races, 1,161 dropped-out before the race and 623 during the race (41.1%); of the total 24,855 runners registered, 7,580 dropped out (30.5%).

Of the 2,469 runners who answered the questionnaire, 18 had a hip or knee replacement and were on 27 start lines and 17 finish lines (63%) (Table 2). We had no answer from runners with a hip or knee replacement who dropped-out before the race.

Symptoms related to the practice of ultra-trail

No responding runner reported a unicompartmental knee arthroplasty. Of the 4 runners with a total knee arthroplasty (TKA), 3 out of 4 had completed the ultra-trail (Table 2).

Two patients had 2 THA (one finished the CCC race, the other dropped-out during the OCC race). In our sample, runners with a THA or TKA were more likely to have run OCC, CCC or TDS races; runners with HRA were more likely to have run UTMB (Table 2).

Among the 6 runners with one or more THA, 6 specific symptoms occurred:

- Before the race: a runner had pubalgia on the side of the arthroplasty requiring a decrease in training load, physiotherapy and icing.
- During the race: 3 runners had groin pain, on the arthroplasty side, requiring for 2 of them a drop-out, and for the third kinesitherapy cares at the refreshments.
- After the race: 2 runners had groin pain requiring rest and physiotherapy.

One patient had symptoms before, during and after the race.

Among the 8 runners with HRA, 2 specific symptoms occurred during the race (none before or after): one runner had groin pain on the operated side, and another had pygalgia. No action or drop-out was required for these runners (Table 3).

4. Discussion

There are few data available in ultra-trail sports, or on the long-term follow-up of patients who have hip or knee joint replacement. However, it is known that some athletes with arthroplasty ran in the Ultra-Trail du Mont-Blanc® (UTMB®). Our results indicate that it is possible to perform ultra-trails after a hip or knee replacement, without a high rate of drop-out. In our sample of 18 runners with joint replacements, 17 finished one of the 27 races (63%). Contrary to expectations, there were fewer drop-outs in the TKA group (1/4; 25%) than in the THA group (3/6; 50%); however, the number of TKA remains low to be able to conclude formally. As for the hip arthroplasty, the runners who had an HRA ran a longer distance than those with a THA (UTMB of 170 km versus OCC and CCC of 51 and 101 km); they also had fewer symptoms (no drop-out after HRA versus 2 drop-outs after THA). The main and specific symptoms for patients with a joint replacement were pubalgia or groin pain, as in the literature [33,35].

It can be emphasized that the characteristics (age, weight, height) were similar in our sample of runners with a hip or knee joint replacement, in our sample of runners without joint replacement, and in samples of recent studies about runners with arthroplasties [31–34].

Our study has several limitations. This is a survey sent to all runners of 3 editions of the UTMB; the response rate was 17.4%. The characteristics of the 82.6% of non-respondents are not known, apart from the drop-out rate. However, the completed questionnaires had no missing data (all questions had required answers before being sent).

Our target population is an extremely rare one. Thus, obtaining answers of 18 runners with 20 joint replacements running in the UTMB® is a relative strength when we know the characteristics of this population, but is also a limitation to the constitution of scientifically rigorous conclusions. Due to this small number of patients, no comparative statistical analysis was conducted.

There was a possible selection bias: the drop-out rate among our sample (41.1%) was higher than the global drop-out rate (30.5%). As the questionnaire was sent by email, the participation of runners who did not use the internet was limited. Nevertheless, registration for the UTMB® is already done on the internet. As the questionnaire was only translated into 3 languages (French, English, Spanish), the studied population was limited. However, these 3 languages are widely spoken by the participants at these French races.

Symptoms were sought in the open field, only for patients with a joint replacement (to look for specific complications, such as loosening or fracture). Some data may be inaccurate: for example, the timing of a symptom was left to the runner's discretion. Nor could we distinguish between a drop-out related to joint replacement and a drop-out related to any other circumstances.

We have included all the races of the UTMB®, including the OCC which is not strictly an ultra-trail (55 km).

Among the runners with hip joint replacement, the rate of finishers and the rate of specific symptoms seems better with HRA than THA. HRA surgery is proposed to young patients, often very athletic with a reassuring bone stock, which is not necessarily the case for patients with THA [38]. However, in our study, the mean age was comparable (43.6 ± 3.2 years for HRA versus 48.3 ± 11.1 for THA); other parameters were not evaluated in the 2 groups, such as those related to running experience, past injuries, training, HRA versus THA indication, self-medication [39], etc.

Several recent studies have addressed the issue of the practice of high-impact sports by athletes with a hip or knee joint replacement and have reached similar conclusions: high-impact sports such as running are possible after HRA without significant complications in the short term [30–35]. Runners can even return to a level

of competition equivalent to the pre-operative level. However, it is recommended to remain cautious about the long-term survival of joint replacements since no study have been conducted with long-term monitoring.

5. Conclusion

The practice of ultra-trail (and *a fortiori* high-impact sports) is possible after hip and/or knee joint replacement.

These data do not lead to any conclusion as for the type of hip replacement to be recommended. However, all the patients with HRA finished the UTMB® races.

Despite these limitations, this study provides a first element of answer for surgeons and runners, as to the possibility of practicing ultra-endurance sports after arthroplasty. Further studies are needed to monitor the long-term fate and survival of joint replacements in ultra-trail runners. Given the difficulty of obtaining enough patients in a race such as the UTMB®, such a study should be considered over several Ultra-Trail World Tour races over the next several years.

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Disclosure of interest

JS, MR, JF, NL, JML declare that they have no conflict of interest.

JG is a consultant for Smith and Nephew, Microport and Corin.

JCR is a designer for Depuy Synthes and Amplitude.

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Author contributions

Michaël Rochoy: study conception and design: data acquisition, analysis and interpretation; supervision; manuscript drafting; manuscript correction

Julien Six: study conception and design: data acquisition, analysis and interpretation; text redaction

Jonathan Favre: relecture; critical manuscript revision

Nicolas Lagrange: data acquisition; relecture

Jean-Marc Lefebvre: relecture; critical manuscript revision

Jean-Charles Rollier: relecture; critical manuscript revision

Julien Girard: original idea; study conception and design: data acquisition, analysis and interpretation; critical manuscript revision

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Figure 1: Flowchart of participations and drop-outs between 2015 and 2017

OCC (55 km) N = 4,420 runners Drop-out = 403 (9.1%)	CCC (101 km) N = 6,401 runners Drop-out = 1,803 (28.2%)	TDS (121 km) N = 5,419 runners Drop-out = 1,894 (35.0%)	UTMB (170 km) N = 7,715 runners Drop-out = 2,929 (38.0%)	PTL (300 km) N = 900 runners Drop-out = 551 (61.2%)
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Runners of UTMB races between 2015 and 2017

N = 24,855
Drop-out = 7,580 (30.5%)

Runners answering the questionnaire

N = 2,469 among 18 with hip and/or knee replacement

OCC (55 km) N = 492 runners Drop-out = 21 (4.3%)	CCC (101 km) N = 863 runners Drop-out = 149 (17.3%)	TDS (121 km) N = 773 runners Drop-out = 192 (24.8%)	UTMB (170 km) N = 1,038 runners Drop-out = 261 (25.1%)	PTL (300 km) N = 5 runners Drop-out = 0 (0%)
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Table 1: Runners of the 2015 to 2017 editions included in our study

Edition	Race	Start line	Cessation	Finish line
2015	OCC	96	2 (2,1 %)	94 (97,9 %)
	CCC	224	41 (18,3 %)	183 (81,7 %)
	TDS	193	43 (22,3 %)	150 (77,7 %)
	UTMB	244	58 (23,8 %)	186 (76,2 %)
	PTL	0	0	0
2016	OCC	131	9 (6,8 %)	122 (93,2 %)
	CCC	231	56 (24,2 %)	175 (75,8 %)
	TDS	211	72 (34,1 %)	139 (65,9 %)
	UTMB	275	93 (33,8 %)	182 (66,2 %)
	PTL	5	0	5 (100 %)
2017	OCC	265	10 (3,8 %)	255 (96,2 %)
	CCC	408	52 (12,7 %)	356 (87,3 %)
	TDS	369	77 (20,9 %)	292 (79,1 %)
	UTMB	519	110 (21,2 %)	409 (78,8 %)
	PTL	0	0	0

OCC: Orsières-Champex-Chamonix, 55 km; CCC: Courmayeur-Champex-Chamonix, 101 km; TDS: Sur les Traces des Ducs de Savoie (On the footpath of the Dukes of Savoy), 121 km; UTMB: Ultra-Trail du Mont-Blanc, 170 km; PTL: Petite Trotte à Léon (Little trot of Leon), 300 km.

Table 2: Distribution of finishers among runners with joint replacement

Races (finishers / runners)		Total hip arthroplasty	Hip resurfacing	Total Knee arthroplasty
OCC	2015	0/1*	0/0	1/1
	2016	0/1*	0/0	0/0
	2017	0/1*	0/0	0/0
CCC	2015	2*/2*	0/0	0/1
	2016	1/2	0/0	1/1
	2017	1/3*	0/0	0/1
TDS	2015	0/0	0/0	0/0
	2016	1/2	0/0	0/0
	2017	0/0	0/0	2/2
UTMB	2015	0/0	2/2	0/0
	2016	0/0	6/6	0/0
	2017	0/1	0/0	0/0
PTL	2015	0/0	0/0	0/0
	2016	0/0	0/0	0/0
	2017	0/0	0/0	0/0

OCC: Orsières-Champex-Chamonix, 55 km; CCC: Courmayeur-Champex-Chamonix, 101 km; TDS: Sur les Traces des Ducs de Savoie (On the footpath of the Dukes of Savoy), 121 km; UTMB: Ultra-Trail du Mont-Blanc, 170 km; PTL: Petite Trotte à Léon (Little trot of Leon), 300 km.

* This number includes a runner with 2 hip total arthroplasties

Table 3: Characteristics of runners who have had joint replacement versus those without joint replacement

Characteristics	Total hip arthroplasty (N = 6) (2 with 2 prothesis)	Hip resurfacing (N = 8)	Total knee arthroplasty (N = 4)	Without replacement (N = 2451)
Male: n (%)	6 (100%)	7 (87,5%)	3 (75%)	2161 (88,16%)
Age: average \pm standard deviation	48,3 \pm 11,08	43,6 \pm 3,23	50,25 \pm 13,9	43,6 \pm 9,74
Weight: average \pm standard deviation	63,8 \pm 3,39	67,2 \pm 9,91	71,5 \pm 19,3	70,01 \pm 9,47
Height: average \pm standard deviation	172,5 \pm 4,51	174 \pm 6,91	173,2 \pm 10,35	175,5 \pm 7,73
Finishers: n (%)	3 (50%)	8 (100%)	3 (75%)	2072 (84,5%)
Musculoskeletal disorders: n (%)	9 (150%)	8 (100%)	7 (175%)	505 (20,6%)
Spinal disorders				
Spinal osteoarthritis	0	0	0	41 (1,7%)
Disc herniation	1 (16,7%)	0	0	20 (0,8%)
Hip disorders				
Coxarthrosis	7 (87,5%)	8 (100%)	0	25 (1,3%)
Femoro-acetabular conflict	0	0	0	6 (0,2%)
Upper femoral epiphysiolysis	1 (16,7%)	0	0	0
Inguinal disorders				
Pubalgia	0	0	0	1 (0,04%)

Knee disorders	Gonarthrosis	0	0	4 (100%)	35 (1,4%)
	Meniscal diseases	0	0	1 (25%%)	144 (5,9%)
	Femoral-patellar syndrome	0	0	3 (75%)	127 (5,2%)
	Tendinopathies	0	0	0	15 (0,6%)
	Ligament disorders	0	0	0	6 (0,2%)
Ankle and foot disorders	Chronic instability	0	0	0	3 (0,1%)
	Plantar fasciitis	0	0	0	5 (0,2%)
	Morton's neuroma	0	0	0	5 (0,2%)
	Tendinopathies	0	0	0	15 (0,6%)
Muscle disorders	Muscular tearing	0	0	0	1 (0,04%)
Inflammatory diseases	Ankylosing spondylitis	0	0	0	6 (0,2%)
	Rheumatoid arthritis	0	0	0	2 (0,08%)
Bone diseases	Osteoporosis	0	0	0	1 (0,04%)
Other		0	0	0	29 (1,2%)
Number of races over 42 km over the last 5 years: average \pm standard deviation		13,2 \pm 7,1	16,2 \pm 4,6	8,7 \pm 3,2	13,7 \pm 10,7
Wearing orthopaedic insoles: n (%)		1 (16,7%)	2 (25%)	1 (25%)	600 (24,5%)
Specific diet: n (%)		0	1 (12,5%)	0	382 (15,6%)
Salt-free		0	0	0	20 (0,8%)
Vegetarian		0	0	0	84 (3,4%)

Ketogenic	0	1 (12,5%)	0	26 (1,1%)
Gluten-free	0	0	0	38 (1,5%)
Others	0	0	0	214 (8,7%)
Specific pre-race symptoms: n (%)	1 (16,7%)	0	0	NC
Specific symptoms during the race: n (%)	3 (50%)	2 (25%)	0	NC
Specific post-race symptoms: n (%)	2 (33,3%)	0	0	NC
Non-specific symptoms during the race: n (%)	3 (50%)	0	0	379 (15,5%)

NC: Not concerned