CASE REPORT

Kite surfing: epidemiology of trauma

Lisa Dunne, Evelyn Murphy, Peter Hugh Dawson, Michael Leonard

Department of Orthopaedics and Trauma, Adelaide and Meath Hospital, incorporating the National Children's Hospital, Dublin, Ireland

Correspondence to

Dr Lisa Dunne, ldunne6@tcd.ie

Accepted 19 March 2018

SUMMARY

Kite surfing has become an increasingly popular recreational activity worldwide. Thrill seekers can span the water at high speeds and reach great heights risking injury and death. We report the case of a young kite surfer who sustained a fracture dislocation of the right acetabulum that required specialised surgical management. We present this case with a review of the literature outlining the incidence of pelvic and acetabular fractures in the kitesurfing community. Overall, there is a low incidence of pelvic fractures in comparison with other orthopaedic traumas reported among kite surfers, and the most commonly injured sites are the foot and ankle. Emergency departments should be alert to this activity and its associated injury patterns due to its ever-increasing popularity.

BACKGROUND

Kite surfing has become an increasingly popular recreational activity since its development in the 1990s.¹ It is a high-risk activity that combines several water sports including surfing, windsurfing and wakeboarding.² Using a large kite and small fibre-glass board, travel occurs by opposing the force of the wind through tension on a string. Participants can span the water at high speeds and reach great heights risking injury and death. While it is resulting in progressively more presentations to emergency departments, acetabular or pelvic fractures as a result of kite surfing are rarely described. We report the case of a kite surfer who sustained a fracture dislocation of the right acetabulum that required specialised surgical management. We present this case with a review of the literature aiming to outline the incidence of pelvic and acetabular fractures as well as other orthopaedic injuries in the kitesurfing community.

CASE PRESENTATION

A 40-year-old man was brought by ambulance to the emergency department following an incident that occurred during recreational kite surfing. This patient had no pertinent medical history. He described having the kite on full power when an unexpected gust of wind blew him from the water onto the sand. He landed an approximated 2 m fall with impact directed through the right proximal femur.

The patient sustained a right posterior femoral head dislocation and a comminuted, displaced fracture of the posterior wall of the ipsilateral acetabulum (figures 1 and 2). His vital signs were stable and he did not suffer significant haemorrhage or head trauma. No associated injuries were identified on secondary survey.

TREATMENT

Following resuscitation, the patient underwent immediate closed reduction of the femoral head under general anaesthetic and application of skeletal traction. He was subsequently transferred to a dedicated centre for the management of pelvic and acetabular fractures where the posterior wall of the acetabulum was openly reduced and internally fixed with two straight acetabular plates (Stryker Matta Pelvic System) (figure 3).

OUTCOME AND FOLLOW-UP

The remainder of the patient's admission was unremarkable and he was discharged home non-weight bearing with crutches. Further follow-up was arranged for 6 weeks at which point he progressed to partial weight bearing, and full weight bearing was commenced on 12-week review.

DISCUSSION

A comprehensive review of EMBASE, PubMed and Google Scholar was conducted with an emphasis on kite surfing and associated pelvic injuries. The search strategy included medical subject headings (MeSH) kitesurf/kitesurfing/kitesurfing hip/kitesurfing pelvis/kitesurfing fracture/kitesurfing injury and yielded 15 relevant articles that described the epidemiology and mechanisms of kite surfing and other water sport injuries; all 15 papers were reviewed. Overall, there is an extremely low incidence of pelvic fractures in comparison with other orthopaedic traumas reported among kite surfers, and the most commonly injured sites are the knee, foot and ankle.³⁻⁷

Figure 1 Plain film X-ray showing right femoral head dislocation and associated posterior wall acetabular fracture.

To cite: Dunne L, Murphy E, Dawson PH, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-223935

Figure 2 CT scan showing right posterior femoral head dislocation and associated posterior acetabular wall fracture.

Injuries tend to result from high-energy impact with land rather than water,⁸ as was seen in the case described above. In 56% of surfers, the injury is sustained due to an inability to detach the kite from the harness.¹⁵ Other key risk factors include misinterpretation of weather conditions, technical mistakes (such as attempting tricks or manoeuvres when lacking sufficient experience) and poor compliance with personal protective equipment.^{13 5} Kupciw and MacGregor found that engaging in particularly risky behaviours is associated with more near misses and accidents in contrast to those taking safety precautions (eg, checking for potential hazards).⁹

Nickel *et al* prospectively examined 235 kite surfers and 124 self-reported kitesurfing injuries of which one patient suffered a fatality while the remainder were mostly isolated injuries at different sites.⁵ In the majority of cases, the impact was to the foot and/or ankle (28%) followed by the skull (14%), chest

Figure 3 Day 1 post-open reduction and internal fixation of the right acetabulum.

(13%) and knee (13%). Potential ankle fractures include talar neck fractures and 'snowboarders ankle', a fracture of the lateral process of the talus that is rarely seen in the general population and commonly overlooked at presentation.⁴

Biomechanical analysis of kite surfing suggests that significant physiological stress is enforced on the musculoskeletal system at different anatomical locations depending on the position of the board and the manoeuvres carried out; this can account for the variability in injury location.¹⁰ In a series of 48 injuries, Grunner *et al* documented that 72.9% were musculoskeletal injuries followed by head injury and chest injury, 18.7% and 14.6%, respectively. Of the orthopaedic injuries 48% were fractures. These were mainly lower limb fractures (58.8%) with the ankle/foot being affected equally as much as the tibia, fibula or femur and upper limb fractures (29.4%) most commonly to radius or ulna. One acetabular fracture and one vertebral fracture were documented.¹¹

Van Bergen *et al* compared kite surfing with windsurfing in the same environmental conditions and proved the injury rate (inclusive only of those requiring emergency medical attention) in kite surfing to be 7/1000 hours in contrast to windsurfing (5.2/1000 hours); however, there was no statistically significant difference in the severity of injury or injury pattern.³

CONCLUSION

The reported case highlights the dangers involved with this sport as well as the role for expert surgical input when presented with an acetabular fracture.¹² The combination of unpredictable wind patterns with the pulling force of large kites make for a high-risk activity,^{2 9} which must be undertaken with caution in order to avoid injury.

Although isolated fracture dislocations of the acetabulum are a rare reason for presentation as a result of this sport to date, bone and soft-tissue injuries are common within the kitesurfing community. Orthopaedic and emergency departments should therefore be alert to the sport and its associated fracture patterns due to its ever-increasing popularity.

Learning points

- Treatment of kitesurfing injuries should be dealt with on a case-by-case basis according to Advanced Trauma life Support protocol and specialist involvement sought in the event of an acetabular fracture¹³ or other significant trauma that may require surgical attention.
- It is essential to be familiar with the rate and pattern of injuries as well as the mechanisms that lead to injuries in order to design efficacious protection equipment (eg, a fast-release system for kite harnesses or safety hook knives to cut kite strings in order to aid speedy detachment).
- Education strategies in popular kite surfing regions which should also aim to advise partakers on correct precautions and methods of assessing weather and tide conditions prior to departure.

Contributors LD: lead author, writer and submitter of case report, researched and wrote majority of literature review. EM: writer of conclusion of case report, read papers that contributed to literature review and provided input on their relevance and ways to include them in the report as well as assistance with final editing. PHD: assisted with literature review, read several papers and provided input with regard to compiling the data; also gave information on the best way to present the surgical technique and plates used for the acetabular fixation outlined in the case report. ML: performed the surgery detailed in the case report and gave the idea for the project as well as providing data from Tallaght Hospital on injury mechanisms for

acetabular fractures and made derivations from said data to assist with case report; also assisted with final editing.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

© BMJ Publishing Group Ltd (unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Exadaktylos AK, Sclabas GM, Blake I, *et al.* The kick with the kite: an analysis of kite surfing related off shore rescue missions in Cape Town, South Africa. *Br J Sports Med* 2005;39:e26.
- 2 Bourgois JG, Boone J, Callewaert M, *et al.* Biomechanical and physiological demands of kitesurfing and epidemiology of injury among kitesurfers. *Sports Med* 2014;44:55–66.
- 3 van Bergen CJ, Commandeur JP, Weber RI, *et al.* Windsurfing vs kitesurfing: injuries at the North Sea over a 2-year period. *World J Orthop* 2016;7:814–20.
- 4 Kristen K, Syré S, Humenberger M. Kitesurfing—injuries and sports medical aspects. *Deutscher Ärzte-Verlag OUP* 2014;3:306–11.
- 5 Nickel C, Zernial O, Musahl V, *et al.* A prospective study of kitesurfing injuries. *Am J Sports Med* 2004;32:921–7.
- 6 Lundgren L, Brorsson S, Osvalder A. Injuries related to kitesurfing. *World Academy of Science Engineering and Technology, International Science Index* 2011;53:1132–6.
- 7 Silva B, Viana R, Gama A, *et al.* Injuries among Portuguese kitesurfers: the most affected body regions. A pilot study. *Motricidade* 2016;11:127.
- 8 Durnford AJ, Harrison SE, Eynon CA. Kitesports: a new source of major trauma? Report of four cases and literature review. *Trauma* 2014;16:23–6.
- 9 Kupciw D, MacGregor A. High-risk sport research. *Sport Exerc Sci* 2012;31:28–9.
- 10 Vercruyssen F, Blin N, L'huillier D, *et al.* Assessment of physiological demand in kitesurfing. *Eur J Appl Physiol* 2009;105:103–9.
- 11 Grunner S, Kotlarsky P, Berkovich Y, *et al.* Epidemiology of kite surfing injuries among recreational athletes. *Isr Med Assoc J* 2016;18:272–4.
- 12 Letournel E. Acetabulum fractures: classification and management. *Clin Orthop Relat Res* 1980;81–106.

Copyright 2018 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.

BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow