Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

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Abstract

Objectives To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Design Systematic review of randomised controlled trials.

Data sources: Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure Death or major trauma, defined as an injury severity score > 15.

Results We were unable to identify any randomised controlled trials of parachute intervention.

Conclusions As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

Introduction

The parachute is used in recreational, voluntary sector, and military settings to reduce the risk of orthopaedic, head, and soft tissue injury after gravitational challenge, typically in the context of jumping from an aircraft. The perception that parachutes are a successful intervention is based largely on anecdotal evidence. Observational data have shown that their use is associated with morbidity and mortality, due to both failure of the intervention and iatrogenic complications. In addition, "natural history" studies of free fall indicate that failure to take or deploy a parachute does not inevitably result in an adverse outcome. We therefore undertook a systematic review of randomised controlled trials of parachutes.

Methods

Literature search

We conducted the review in accordance with the QUOROM (quality of reporting of meta-analyses) guidelines. We searched for randomised controlled trials of parachute use on Medline, Web of Science, Embase, the Cochrane Library, appropriate internet sites, and citation lists. Search words employed were "parachute" and "trial." We imposed no language restriction and included any studies that entailed jumping from a height greater than 100 metres. The accepted intervention was a fabric device, secured by strings to a harness worn by the participant and released (either automatically or manually) during free fall with the purpose of limiting the rate of descent. We excluded studies that had no control group.

Definition of outcomes

The major outcomes studied were death or major trauma, defined as an injury severity score greater than 15.

Meta-analysis

Our statistical approach was to assess outcomes in parachute and control groups by odds ratios and quantified the precision of estimates by 95% confidence intervals. We chose the Mantel-Haenszel test to assess heterogeneity, and sensitivity and subgroup analyses and fixed effects weighted regression techniques to explore causes of heterogeneity. We selected a funnel plot to assess publication bias visually and Egger's and Begg's tests to test it quantitatively. Stata software, version 7.0, was the tool for all statistical analyses.

Results

Our search strategy did not find any randomised controlled trials of the parachute.

Discussion

Evidence based pride and observational prejudice

It is a truth universally acknowledged that a medical intervention justified by observational data must be in want of verification through a randomised controlled studies that had no control group.
Hazardous journeys

Trial. Observational studies have been tainted by accu-
sations of data dredging, confounding, and bias. For
example, observational studies showed lower rates of
ischaemic heart disease among women using hormone
replacement therapy, and these data were interpreted
as advocating hormone replacement for healthy
women, women with established ischaemic heart
disease, and women with risk factors for ischaemic
heart disease. However, randomised controlled trials
showed that hormone replacement therapy actually
increased the risk of ischaemic heart disease, indicating
that the apparent protective effects seen in
observational studies were due to bias. Cases such as
this one show that medical interventions based solely
on observational data should be carefully scrutinised,
and the parachute is no exception.

Natural history of gravitational challenge
The effectiveness of an intervention has to be judged
relative to non-intervention. Understanding the natu-
ral history of free fall is therefore imperative. If failure
to use a parachute were associated with 100% mortality
then any survival associated with its use might be con-
sidered evidence of effectiveness. However, an adverse
outcome after free fall is by no means inevitable.
Survival has been reported after gravitation challenges
of more than 10 000 metres (33 000 feet). In addition,
the use of parachutes is itself associated with morbidity
and mortality. This is in part due to failure of the
intervention. However, as with all interventions,
parachutes are also associated with iatrogenic compli-
cations. Therefore, studies are required to calculate the
balance of risks and benefits of parachute use.

The parachute and the healthy cohort effect
One of the major weaknesses of observational data is
the possibility of bias, including selection bias and
reporting bias, which can be obviated largely by using
randomised controlled trials. The relevance to
parachute use is that individuals jumping from aircraft
without the help of a parachute are likely to have a
high prevalence of pre-existing psychiatric morbidity.
Individuals who use parachutes are likely to have less
psychiatric morbidity and may also differ in key demo-
graphic factors, such as income and cigarette use. It
follows, therefore, that the apparent protective effect of
parachutes may be merely an example of the “healthy
cohort” effect. Observational studies typically use mul-
tivariate analytical approaches, using maximum likeli-
hood based modelling methods to try to adjust
estimates of relative risk for these biases. Distasteful as
these statistical adjustments are for the cognoscenti of
evidence based medicine, no such analyses exist for
assessing the presumed effects of the parachute.

The medicalisation of free fall
It is often said that doctors are interfering monsters
obsessed with disease and power, who will not be satis-
fied until they control every aspect of our lives (Journal
of Social Science, pick a volume). It might be argued that
the pressure exerted on individuals to use parachutes is
yet another example of a natural, life enhancing experience being turned into a situation of fear and
dependency. The widespread use of the parachute may
just be another example of doctors’ obsession with dis-
case prevention and their misplaced belief in unproved
technology to provide effective protection against occasional adverse events.

Parachutes and the military industrial complex
However sinister doctors may be, there are powers at
large that are even more evil. The parachute industry
has earned billions of dollars for vast multinational
corporations whose profits depend on belief in the
efficacy of their product. One would hardly expect
these vast commercial concerns to have the bravery to
test their product in the setting of a randomised
controlled trial. Moreover, industry sponsored trials
are more likely to conclude in favour of their commer-
cial product, and it is unclear whether the results of
such industry sponsored trials are reliable.

A call to (broken) arms
Only two options exist. The first is that we accept that,
under exceptional circumstances, common sense
might be applied when considering the potential risks
and benefits of interventions. The second is that we
continue our quest for the holy grail of exclusively
evidence based interventions and preclude parachute
use outside the context of a properly conducted trial.
The dependency we have created in our population
may make recruitment of the unenlightened masses to
such a trial difficult. If so, we feel assured that those
who advocate evidence based medicine and criticise
use of interventions that lack an evidence base will not
hesitate to demonstrate their commitment by volun-
teering for a double blind, randomised, placebo
controlled, crossover trial.

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1 Belmont PJ Jr, Taylor RF, Mason KT, Shawen SR, Polly DW Jr, Klemme

WR. Incidence, epidemiology, and occupational outcomes of thoraco-


What is already known about this topic
Parachutes are widely used to prevent death and
major injury after gravitational challenge.

Parachute use is associated with adverse effects
due to failure of the intervention and iatrogenic
injury.

Studies of free fall do not show 100% mortality.

What this study adds

No randomised controlled trials of parachute use
have been undertaken.

The basis for parachute use is purely observational,
and its apparent efficacy could potentially be
explained by a “healthy cohort” effect.

Individuals who insist that all interventions need
to be validated by a randomised controlled trial
need to come down to earth with a bump.
In 1798 Napoleon Bonaparte conquered Egypt with an army of 55,000 men. With his army was a party of 300 men of science and letters whose objective was to record the culture of Egypt. The result was an extensive series of writings and engravings known as the *Description de l’Égypte*. Part of this great work was devoted to recording the health and wellbeing of the people of Egypt, as observed by Bonaparte’s surgeons and physicians. In this article we draw attention to some of their achievements.

**French men of medical science**

The scientists were selected by Claude Louis Berthollet, who studied medicine and served on scientific committees during the French Revolution (fig 1). He placed in charge of the army’s medical services Dr René-Nicolas Desgenettes, who was the expedition’s chief medical officer. In Egypt, Desgenettes busied himself with the welfare of the French army and the wellbeing of the Egyptian people. He also read papers to the French Institute at Cairo on the causes of ophthalmia and infant mortality. Remarkably, he inoculated himself with pus from a suppurating bubo to fortify himself against bubonic plague. Desgenettes outlined ideas for a new hospital, a pharmacy, and a school of medicine at Cairo.

The celebrated French naturalist and anatomist Georges Léopold Cuvier was invited to participate. In his place went one of the most revered men of French medicine, Dr Dominique-Jean Larrey. Bonaparte called him “the most virtuous man I have ever known.” One of Larrey’s contributions to military medicine was the *ambulance volante* (flying ambulance) that enabled wounded men to be transported from the scene of conflict (fig 2). Larrey published his Egyptian medical researches as *Mémoires et Observations sur plusieurs Maladies*. He was later appointed doctor in surgery and medicine at Paris and was subsequently elevated to a peerage with the titles Monsieur Le Baron and Chevalier de la Légion d’Honneur.

**Tribulations of the military**

The French army had to march through the desert to Cairo. The soldiers were maddened by thirst, and their torment was increased by the image of a lake—their first experience of the illusion of a mirage. On reaching the Nile, the troops gorged themselves on watermelons, which carried their own hazards; scores of men became afflicted by waterborne bacteria and...

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