Frequency of injuries associated with syncope in the prevention of syncope trials

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Aims

Syncope can lead to injuries. We determined the frequency, severity, and predictors of injuries due to syncope in cohorts of syncope patients.

Methods and results

Participants were enrolled in the POST2 (fludrocortisone) and POST4 (midodrine) vasovagal syncope (VVS) randomized trials, and POST3 enrolled patients with bifascicular block and syncope. Injury was defined as minor (bruising, abrasions), moderate (lacerations), and severe (fractures, burns, joint pain), and recorded up to 1 year after enrolment. A total of 459 patients (median 39 years) were analysed. There were 710 faints occurred in 186 patients during a 1-year follow-up. Fully 56/186 (30%) of patients were injured with syncope (12% of overall group). There were 102 injuries associated with the 710 faints (14%), of which 19% were moderate or severe injuries. Neither patient age, sex, nor the presence of prodromal symptoms associated with injury-free survival. Patients with bifascicular block were more prone to injury (relative risk 1.98, $P=0.018$). Patients with ≥ 4 faints in the prior year had more injuries than those with fewer faints (relative risk 2.97, $P<0.0001$), but this was due to more frequent syncope, and not more injuries per faint. In VVS patients, pharmacological therapy significantly reduced the likelihood of an injury due to a syncopal spell (relative risk 0.64, $P=0.015$). Injury severity did not associate with age, sex, or prior-year syncope frequency.

Conclusion

Injuries are frequent in syncope patients, but only 4% of injuries were severe. None of age, sex, and prodromal symptoms associate with injury.

Keywords

Syncope • Vasovagal • Injury • Injury severity • Clinical trial

Introduction

Syncope is a common clinical problem affecting at least 40% of adults in their lifetime, and recurs in at least 13% of adults.^{1,2} Syncope recurrences affect physical, psychological, and psychosocial aspects of daily life and lead to reduced quality of life.^{3,4} Vasovagal syncope (VVS) is the most common type of syncope, accounting for about half of syncope presentations to emergency departments.⁵ Vasovagal syncope does not increase the risk of death for most patients, and many physicians consider it a benign affliction. However, sudden incapacitation

can cause injury, and we do not know the likelihood and severity of injuries due to a syncopal spell.

Injury data are available from three Prevention of Syncope Trials (POST), including the POST2⁶ study of fludrocortisone in VVS, the POST4⁷ study of midodrine in VVS, and the POST3⁸ study, which was a pragmatic randomized trial of pacing vs. implantable loop recorders in generally elderly patients with bifascicular block and syncope. All three studies collected detailed information about injuries and their severity with each syncopal spell.

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What's new?

- We determined the frequency, severity, and predictors of injuries due to syncope in cohorts of 459 syncope patients in three randomized clinical trials of syncope.
- Injuries occurred in 14% of patients.
- Eighty-one percent of injuries were only abrasions or contusions.
- Neither age nor sex predicted injuries.
- Patients with a recent history of more frequent syncope were also more likely to be injured.
- Active pharmacologic treatment reduced the risk of injury with each faint.

The present study aimed to investigate the frequency, severity, and predictors of injuries due to syncope in patients with a confirmed diagnosis of syncope in the POST2,⁶ POST3,⁸ and POST4⁷ studies during a 1-year follow-up. We analysed the predictive effects of demographic and symptom characteristics, as well as the impact of pharmacological therapy on the likelihood of injuries from syncope.

Methods

Study populations

The study population consisted of syncope patients who were enrolled in one of three randomized syncope trials. The POST2 trial⁶ studied fludrocortisone in VVS (NCT00118482), the POST4 trial⁷ studied midodrine in VVS (NCT01456481), and the POST3 trial⁸ was a pragmatic randomized trial of pacing vs. implantable loop recorders in generally elderly patients with bifascicular block and syncope (NCT01423994). POST2 and POST4 included normotensive patients with at least two VVS spells ascertained with the Calgary Syncope Symptom Score. POST3 included patients at least 50 years old with bifascicular block and at least one syncopal spell in the previous year, and no clear diagnosis. All three studies were approved by ethics review committees in all centres. In all three studies, patients were asked to notify the nurse coordinator as soon as possible after a syncopal spell. Syncope incidence and descriptors and details of injuries were captured in prespecified case report forms and open text narratives.

Analytic approach

We described the incidence of injuries on a per-person and per-faint basis, including categorization by severity. Syncope severity was defined as minor (bruising), moderate (abrasions, lacerations), and severe (fracture, burns, head injury, or joint pain). We then tested the association of demographic, symptom, and treatment variables with the likelihood of injury.

Statistical analysis

We used SPSS 21 (IBM Corporation, Armonk, NY, USA) for data analysis. Summary descriptions included means and standard deviations, or medians and interquartile intervals where appropriate. Survival analysis used the Kaplan–Meier technique with the statistical significance of differences tested with the Wilcoxon log-rank test. The significance of associations of categorical values were tested with the χ^2 or Fisher's exact tests (conditional on expected counts). The differences between distributions were tested with T-tests.

Results

Study populations

In the three study populations, there were a total of 459 syncope patients [median 39 years old; 278 (61%) female; *Table 1*]. POST2 enrolled 210 patients (mean 34 years; 70% female), with a median syncope frequency of 4 in the year prior to enrolment, and a median duration of follow-up of 7.8 months. POST4 enrolled 134 patients (mean 35 years; 73% female), with a median syncope frequency of 6 in the year prior to enrolment, and a median duration of follow-up of 8.7 months. POST3 enrolled 115 patients (mean 76 years; 30% female), with a median syncope frequency of 2 in the year prior to enrolment, and a median duration of follow-up of 33 months.

Syncope and injuries

During a 1-year follow-up period, 186 patients had at least one episode of syncope and there was a total of 710 faints (*Figure 1*, top panel). Of the 186 patients who fainted, 56 (30%) had at least one injury related to syncope (12% of the total study population of 459 patients, *Table 2*; *Figure 1*, top panel). In the patients who fainted, none of age, sex, type of population, presence of prodrome, or drug therapy associated with the likelihood of a patient reporting being injured (*Table 3*). An injury related to syncope occurred in 102 of the 710 (14%) syncopal episodes (*Table 4*). Of the 102 total injuries, 83 (81%) were minor, 15 (15%) were moderate, and 4 (4%) were severe in nature (*Table 1*; *Figure 2*).

Injury in each study

Of the 115 patients with bifascicular block (POST3), 21 (18%) fainted at least once over the first 12 months of follow-up, and 10 (8%) reported at least one injury related to syncope (*Table 1*). Over the first 12 months, there were 37 faints, of which 10 (27%) resulted in injury (*Table 1*). Of the 344 patients with VVS (POST2 and POST4), 165 (48%) fainted at least once during follow-up, and 47 (14%) reported at least one injury due to syncope. Over the 12 months, there were 673 faints in VVS patients, of which 92 (14%) resulted in injury.

More patients with VVS had a syncope recurrence during 12 months follow-up than patients with bifascicular block (48% vs. 18%; $P < 0.0001$). Patients with VVS who fainted did not have a significantly different risk of injury due to syncope during 12 months follow-up than patients with bifascicular block (*Table 3*, 28% vs. 43%; relative risk 0.66, $P = 0.15$). In contrast, patients with bifascicular block had a significantly higher risk of injury per faint than VVS patients (*Table 4*, 27% vs. 14%; relative risk 1.98, $P = 0.018$). Of the 344 patients with VVS (POST2 and POST4), 165 (48%) fainted at least once during follow-up, and 47 (14%) reported at least one injury due to syncope. Over the 12 months, there were 673 faints in VVS patients, of which 92 (14%) resulted in injury.

Patients with VVS had a numerically higher risk of injury due to syncope during 12 months follow-up than patients with bifascicular block (*Table 2*, 14% vs. 8%; relative risk 1.59, $P = 0.089$). In contrast, patients with bifascicular block had a significantly higher risk of injury per faint than VVS patients (*Table 4*, 27% vs. 14%; relative risk 1.98, $P = 0.018$). In other words, the bifascicular block patients were more likely to be injured if they fainted.

Table 1 Baseline demographics and frequency of injuries

	POST 2	POST 4	POST 2 and 4	POST 3	Total
Patients, <i>n</i>	210	134	344	115	459
Mean age	34	35	35	76	45
Female, <i>n</i> (%)	146 (70%)	98 (73%)	244 (71%)	34 (30%)	278 (61%)
Syncope in prior year, median	4	6	5	2	3
Median follow-up duration, months	7.8	8.7	8.4	33.0	11.9
Patients fainted, <i>n</i> (%)	97 (46%)	68 (51%)	165 (48%)	21 (18%)	186 (41%)
Patients injured, <i>n</i>	29	18	47	9	56
Patients injured, % total	14%	13%	14%	8%	12%
Patients injured, % of fainters	30%	26%	28%	43%	30%
Total number of faints, <i>n</i>	453	220	673	37	710
Total number of injuries, <i>n</i>	53	39	92	10	102
Injuries per faint, %	12%	18%	14%	27%	14%
Minor injuries, <i>n</i> (%)	41 (77%)	36 (92%)	77 (84%)	6 (60%)	83 (81%)
Moderate injuries, <i>n</i> (%)	10 (19%)	2 (5%)	12 (13%)	3 (30%)	15 (15%)
Severe injuries, <i>n</i> (%)	2 (4%)	1 (3%)	3 (3%)	1 (10%)	4 (4%)

Predictors of injury severity

When injury severity was analysed by minor vs. moderate/severe, none of age ($P = 0.4$), sex ($P = 0.6$), or prior-year syncope frequency ($P = 0.9$) predicted injury severity. Syncope patients with bifascicular block had a trend towards a greater proportion of moderate or severe injuries than VVS patients (40% vs. 16%, $P = 0.087$; Table 1).

Demographics and syncope-related injury

Females with syncope were more likely to be injured, having a lower injury-free survival at 1 year than males (65% vs. 85%; $P = 0.03$; Figure 1, middle panel). They were also more likely to faint (females 527 faints/278 fainters; males 183 faints/181 fainters). Similarly, a significantly higher proportion of females than males were injured due to syncope (15% vs. 8%, relative risk 1.78, $P = 0.044$; Table 2). Females who fainted reported a similar risk of injury per patient as did men (Table 3, 31% vs. 27%, $P = 0.59$). However, the risk of injuries per faint in males and females were similar (15% vs. 14%, relative risk = 1.05, $P = 0.82$, Table 4). Populations older and younger than the median age had similar proportions of patients injured due to syncope (13% vs. 11%, $P = 0.32$; Table 2) and similar likelihoods of injuries per faint (15% vs. 14%, $P = 0.39$; Table 4).

Prior-year syncope and syncope-related injury

The number of faints in the year before study enrolment predicted more likely injury in the follow-up period. At least 38% of patients with four or more faints in the prior year were injured during syncope compared to only 24% of those with fewer than four faints in the prior year ($P = 0.03$; Figure 1, bottom panel). Similarly, Table 2 reports that patients with more than the median number of faints in the prior year were more likely to be injured (19% vs. 6%, relative risk 2.97, $P < 0.0001$; Table 2).

In contrast, the proportion of injuries *per faint* was significantly higher in patients with less frequent syncope in the prior year (22% vs. 14%, relative risk 1.60, $P = 0.0027$; Table 4). That is, patients with more frequent syncope were more likely to be injured, and less likely to be injured per faint. The higher likelihood of injury was due to the higher likelihood of syncope, and not a higher risk of injury per faint.

Prodromes

The presence of prodromal symptoms was recorded only from patients enrolled in POST3 and POST4. Of the 89 patients who fainted during the 12-month observation period, 61 (69%) patients had prodrome symptoms, and 28 (31%) did not have prodromal symptoms. There was a trend towards a lower proportion of syncope patients with prodromal symptoms having an injury than those without prodromal symptoms (39% vs. 24%; relative risk 1.60, $P = 0.075$; Table 2). As well, the likelihood of injury per faint in patients with and without prodromal symptoms were similar 25% and 16% (relative risk 1.60, $P = 0.10$; Table 4).

Drug treatment and injury

Among VVS patients enrolled in the POST2 and POST4 studies, patients assigned to treatment with either fludrocortisone or midodrine had a significantly lower likelihood of injury per syncopal episode than those in the placebo group (Table 4). The relative risk of injury per faint for patients on active treatment compared to placebo was 0.64 (95% confidence interval 0.43–0.96, $P = 0.015$). In the bifascicular population, there was no evidence that pacemakers reduce the risk of injury compared to permanent pacemakers.

National perspectives

To estimate rates of severe injury without syncope we compared fall-related injuries leading to hospital admissions in four national datasets (Table 5) with the data from POST 2–4. Serious injuries were generally defined as fractures or head trauma, which is similar to our definition. In Denmark,⁹ Canada,¹⁰ the UK,¹¹ and the USA,

the¹² proportions of the populations admitted with fall-related injuries were 3.2%, 0.4%, 0.33%, and 0.24%, respectively. In POST 2–4, the risk of serious injury was 4/459, or 0.9%.

Discussion

Using prospectively collected data from three randomized trials, we estimated the likelihood of injuries during syncope. Overall, there is a 14% risk of injury per faint, and almost one-fifth of these are moderate or severe in nature. Fully 30% of patients who faint are injured in a 1-year observation period. The risk of injury is higher in patients with more frequent syncope. Modestly effective drug therapy significantly reduces the risk of injury in VVS patients.

Syncope is very common, and often assumed to be troublesome but not particularly dangerous.¹ There is a significant psychosocial impact on quality of life, which is reduced substantially in patients with recurrent syncope.^{3,13,14} In particular, Ng *et al.*³ reported in patients with VVS that the most severely reduced of eight dimensions of quality of life was physical role functioning. Patients feel limited in their physical roles and are significantly more anxious than matched subjects who do not faint. The results reported here substantiate these apprehensions and anxiety: the risk of injury is significant with each faint, and some of these injuries are moderate to severe in severity. The risk of injury per faint in the total study population was 14%, with patients having bifascicular block at significantly higher risk than those with VVS. In this population, followed for no more than 1 year, the risk of injury per person was 12%, with similar groups at higher risk. Fortunately, the large majority of injuries (81%) are no worse than abrasions and contusions, and the likelihood of severe injuries per faint is only 4%.

Injuries due to syncope have been reported by others, although usually in cross-sectional surveys.^{15–17} Bartoletti *et al.*¹⁸ reported the prevalence of injuries related to syncope at the time of presentation at the emergency room. There was an incidence of 29% of traumatic injuries for all syncope causes, and 24% for VVS. Ammirati *et al.*¹⁵ recorded detailed histories of 346 patients with at least two recent spells of VVS. Fully 27% had been injured at least once, and 9% were admitted to hospital because of the degree of injury. Factors that predicted injury included male sex, more frequent syncope, and a shorter prodromal period. One strength of the results reported here is that the data were collected prospectively and over a reporting period up to a year, rather than at a single timepoint in the patients' lives.

Our results complement those of Aydin *et al.*,¹⁷ who followed 316 patients with syncope after an initial assessment. The mean age was 50 years and they had had a median of 3 syncopal spells in about 1 year before assessment. Only 40% had positive tilt tests. All received diagnostic explanation, reassurance, and dietary and counter-pressure manoeuvre education, as did our patients. In a 2-year telephone and mail follow-up only 27% of patients reported a syncope recurrence. Injuries occurred in 17/87 patients with syncope (20%) and 17/316 patients who completed follow-up (5.4%). In contrast, our patients had a higher reported likelihood of both syncope and injuries. Possible contributing factors include a higher risk population in clinical trials, unreported differences in confounding factors, and much more intense follow-up and reporting in clinical trials. As

Figure 1 Survival free of events in follow-up. Top panel, comparison of syncope and injury rates in the total population. Middle panel, comparison of survival free of injury in males and females. Bottom panel, comparison of survival free of injury in patients with more or fewer than the median numbers of faints in the year before study enrolment. The median number of faints in the year before randomization was 3.

well, Aydin *et al.*¹⁷ focused on the effect of conservative treatment, while our analysis aimed to determine risk factors for both injuries per person and importantly injuries per faint.

To estimate rates of severe injury without syncope we compared fall-related injuries leading to hospital admissions in four national datasets (Table 5) with the data from POST 2–4. There is no control

Table 2 Risk factors for injury per patients

Population	Size, <i>n</i>	Injured, <i>n</i>	Mean risk (CI)	Relative risk (CI)	P-value
Total	459	56	0.12 (0.10–0.15)		
Sex					
Male	181	15	0.08 (0.05–0.13)		
Female	278	41	0.15 (0.11–0.19)	1.78 (1.02–3.12)	0.044
Age					
<Median	214	28	0.13 (0.09–0.18)		
>Median	245	28	0.11 (0.08–0.16)	0.87 (0.54–1.43)	0.32
Population type					
Bifascicular block	115	9	0.08 (0.04–0.14)		
Vasovagal	344	47	0.14 (0.10–0.18)	1.59 (0.81–3.14)	0.089
Prior year, <i>n</i>					
<Median	239	15	0.06 (0.04–0.10)		
>Median	220	41	0.19 (0.14–0.24)	2.97 (1.69–5.21)	<0.0001
Prodrome					
Absent	61	15	0.25 (0.15–0.37)		
Present	28	11	0.39 (0.24–0.58)	1.60 (0.85–3.02)	0.075
Drug therapy					
Placebo	172	24	0.14 (0.10–0.20)		
Active	172	23	0.13 (0.09–0.19)	0.96 (0.56–1.63)	0.88

The mean age in the total study population was 45 and the median number of faints in the year before randomization was 3. Prodromal symptoms were recorded in POST 3 and 4. The bifascicular heart block population was in POST 3 and the vasovagal population was in POST 2 and 4.
CI, confidence interval.

Table 3 Risk factors for injury in patients who fainted

Population	Size, <i>n</i>	Injured, <i>n</i>	Mean risk (CI)	Relative risk (CI)	P-value
Total	186	56	0.30 (0.24–0.37)		
Sex					
Male	55	15	0.27 (0.15–0.45)		
Female	131	41	0.31 (0.22–0.42)	0.87 (0.53–1.44)	0.59
Age					
<Median	110	28	0.25 (0.17–0.37)		
>Median	76	28	0.37 (0.24–0.53)	0.69 (0.45–1.10)	0.10
Population type					
Bifascicular block	21	9	0.43 (0.24–0.63)		
Vasovagal	165	47	0.28 (0.22–0.36)	0.66 (0.38–1.15)	0.15
Prior year, <i>n</i>					
<Median	50	15	0.30 (0.17–0.50)		
>Median	136	41	0.30 (0.22–0.41)	0.99 (0.61–1.63)	0.98
Prodrome					
Absent	58	15	0.52 (0.29–0.85)		
Present	31	11	0.24 (0.12–0.43)	0.73 (0.38–1.39)	0.34
Drug therapy					
Placebo	95	24	0.25 (0.16–0.38)		
Active	70	23	0.33 (0.21–0.49)	0.77 (0.48–1.24)	0.28

The mean age in the total study population was 45 and the median number of faints in the year before randomization was 3. Prodromal symptoms were recorded in POST 3 and 4. The bifascicular heart block population was in POST 3 and the vasovagal population was in POST 2 and 4.
CI, confidence interval.

Table 4 Risk factors for injury per faint

Population	Size, <i>n</i>	Injuries, <i>n</i>	Mean risk (CI)	Relative risk (CI)	P-value
Total	710	102	0.14 (0.12–0.17)		
Sex					
Male	154	23	0.15 (0.10–0.21)	1.05 (0.68–1.61)	0.82
Female	556	79	0.14 (0.12–0.17)		
Age					
<Median	346	51	0.15 (0.11–0.19)	1.05 (0.74–1.51)	0.39
>Median	364	51	0.14 (0.11–0.18)		
Population type					
Bifascicular block	37	10	0.27 (0.15–0.43)	1.98 (1.13–3.47)	0.018
Vasovagal	673	92	0.14 (0.11–0.17)		
Prior year, <i>n</i>					
<Median	74	16	0.22 (0.14–0.32)	1.60 (0.99–2.57)	0.027
>Median	636	86	0.14 (0.11–0.16)		
Prodrome					
Absent	116	29	0.25 (0.18–0.34)	1.60 (0.91–2.81)	0.10
Present	96	15	0.16 (0.10–0.24)		
Drug therapy					
Placebo	360	59	0.16 (0.13–0.21)		
Active	313	33	0.11 (0.08–0.15)	0.64 (0.43–0.96)	0.015
Device therapy					
ILR	11	5	0.40 (1.1–10.2)		
Pacemaker	10	4	0.45 (1.6–11.7)	1.1 (0.42–3.1)	0.8

Size, *n* is the number of faints. Injured, *n* is the number of faints resulting in an injury. The mean age in the total study population was 45 and the median number of faints in the year before randomization was 3. Prodromal symptoms were recorded in POST 3 and 4. The bifascicular heart block population was in POST 3 and the vasovagal population was in POST 2 and 4.

CI, confidence interval; ILR, implantable loop recorder.

Figure 2 Distribution of minor, moderate, and severe injuries associated with syncopal spells.

group without syncope and we cannot determine directly whether syncope increases the overall risk of fall-related injury.⁹ These are structurally similar controls in that they report the admission rates for injuries for all subjects, rather than based on a syncope-related injury. Assuming that many fall-related severe injuries would be hospitalized these provide an estimate of their incidence. The apparent differences between Danish⁹ and USA,¹² UK,¹¹ Canadian¹⁰ estimates may be due to differences in populations, inclusion criteria, active study enrolment compared to passive administrative datasets, and analytic methodologies.

Females are at higher risk of fainting and of injury due to fainting, both per person and per faint. However, their risk of injury per faint was similar to that of males, suggesting that this effect was simply due to females fainting more frequently in follow-up. Age was not a factor, as older and younger patients had similar risks of injury.

The significantly worse outcome of syncope patients with bifascicular block does raise concerns. These patients had both an increased risk of injury per faint and an increased risk of moderate and severe injury. This does not seem to be a simple matter of increased age. We conjecture this may be due to the presence of multiple comorbidities and risk factors, including possibly osteoporosis,¹⁹ lack of mobility,²⁰ and frailty²¹ in this older cohort. Age by itself did not predict injury, but women with bifascicular block appear to be at

Table 5 Rates of admissions for serious fall-related injury in Denmark, the USA, the UK, and Canada

Population	Data type	Inclusion	Period 2	%
Danish national	Administrative	No recent syncope	One-year admission due to fall-related injury	3.2
US national	Administrative	Injury admission	One-year admission due to fall-related injury	0.24
UK national	Administrative	Injury admission	One-year admission due to fall-related injury	0.33
Canadian national	Administrative	Injury admission	One-year admission due to fall-related injury	0.4
All study patients	POST 2–4	Recent syncope	One-year syncope-related serious injury	0.9

These populations serve as controls for the likelihood of serious injury not related to syncope.

particularly elevated risk of injury. Given the impact of fractures on the elderly, it may be that aggressive early intervention is warranted, and a formal geriatrics consultation might be helpful. Working with a Falls clinic may also be helpful.

Limitations

Participants included in this analysis were all enrolled in clinical trials, which means that they were highly selected and self-selected, which might limit the generalizability of the results. Possibly this overestimated the likelihood of being injured with each faint, although we did not detect this effect. Only patients with recurrent syncope are included in this series and not solely patients with the first episode. As well, the proportion of patients who were injured is similar to that reported by Aydin *et al.*,¹⁷ using a related but lower risk study population. There is no control group without syncope and we cannot determine directly whether syncope increases the overall risk of fall-related injury.⁹ We did not collect uniform information on comorbidities (POST2 and POST4 anticipated a predominantly young and healthy population) or about prodromal symptoms (not collected in POST2). The population of POST 3 is quite different from that of POST2 and 4, and care should be taken when combining the data. To ameliorate this we also examined bifascicular block as a separate risk factor. The patients in POST3 were about 40 years older than those in POST2 and 4 yet constitute only 25% of the study population. This relatively small sample size of older patients may have prevented us from detecting serious injuries such as hip fractures. These can lead to serious morbidities and occasionally mortality. Even when considered in aggregate, this study's sample size was too small to ask more detailed and specific questions, such as about the interactions of medication and prodromes and risk factors that predict severe injury. Since the majority of patients with a known diagnosis of syncope do not seek medical attention, the unselected population rate of injuries due to syncope is unknown.

Conclusion

The frequency of injuries is significant in patients with syncope, including VVS, although most are simply contusions and abrasions. Patients with conduction disease appear to be a higher risk group requiring particular care. Patients and physicians should be alert to the consequences of recurrent syncope and injuries, and that females and patients with frequent syncope are more likely to be injured. Finally, patients with syncope should be assessed for other factors

that increase the risk of moderate to severe trauma including comorbidities, frailty, specific occupational risk, and sports activities.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

- Shen W-K, Sheldon RS, Benditt DG, Cohen MI, Forman DE, Goldberger ZD *et al.* 2017 ACC/AHA/HRS Guideline for the evaluation and management of patients with syncope. *J Am Coll Cardiol* 2017;**70**:e39–110.
- Ruwalid MH, Hansen ML, Lamberts M, Hansen CM, Numé AK, Vinther M *et al.* Comparison of incidence, predictors, and the impact of co-morbidity and polypharmacy on the risk of recurrent syncope in patients <85 versus ≥85 years of age. *Am J Cardiol* 2013;**112**:1610–5.
- Ng J, Sheldon RS, Ritchie D, Raj V, Raj SR. Reduced quality of life and greater psychological distress in vasovagal syncope patients compared to healthy individuals. *Pacing Clin Electrophysiol* 2018;**42**:180–8.
- Barón-Esquivias G, Gómez S, Aguilera A, Campos A, Romero N, Cayuela A *et al.* Short-term evolution of vasovagal syncope: influence on the quality of life. *Int J Cardiol* 2005;**102**:315–9.
- Blanc J-J, L'Her C, Touiza A, Garo B, L'Her E, Mansourati J. Prospective evaluation and outcome of patients admitted for syncope over a 1 year period. *Eur Heart J* 2002;**23**:815–20.
- Sheldon R, Raj SR, Rose MS, Morillo CA, Krahn AD, Medina E *et al.* Fludrocortisone for the prevention of vasovagal syncope. *J Am Coll Cardiol* 2016;**68**:1–9.
- Raj SR, Faris PD, McRae M, Sheldon RS. Rationale for the prevention of syncope trial IV: assessment of midodrine. *Clin Auton Res* 2012;**22**:275–80.
- Krahn AD, Morillo CA, Kus T, Manns B, Rose S, Brignole M *et al.* Empiric pacemaker compared with a monitoring strategy in patients with syncope and bifascicular conduction block-rationale and design of the Syncope: pacing or Recording in The Later Years (SPRITELY) study. *Europace* 2012;**14**:1044–8.
- Numé A-K, Carlson N, Gerds TA, Holm E, Pallisgaard J, Søndergaard KB *et al.* Risk of post-discharge fall-related injuries among adult patients with syncope: a nationwide cohort study. *PLoS One* 2018;**13**:e0206936.
- Slips, trips and falls: Our newest data reveals causes of injury hospitalizations and ER visits in Canada | CIHI. <https://www.cihi.ca/en/slips-trips-and-falls-our-newest-data-reveals-causes-of-injury-hospitalizations-and-er-visits-in> (June 2020, date last accessed).
- Falls: applying All Our Health - GOV.UK. <https://www.gov.uk/government/publications/falls-applying-all-our-health/falls-applying-all-our-health> (December 2020, date last accessed).

12. WISQARS (Web-based Injury Statistics Query and Reporting System)|Injury Center|CDC [Internet]. <https://www.cdc.gov/injury/wisqars/> (December 2020, date last accessed).
13. Ng J, Sheldon RS, Maxey C, Ritchie D, Raj V, Exner DV et al. Quality of life improves in vasovagal syncope patients after clinical trial enrollment regardless of fainting in follow-up. *Auton Neurosci Basic Clin* 2019;**219**:42–8.
14. Grimaldi Capitelto T, Fiorilli C, Placidi S, Vallone R, Drago F, Gentile S. What factors influence parents' perception of the quality of life of children and adolescents with neurocardiogenic syncope? *Health Qual Life Outcomes* 2016;**14**:1–9.
15. Ammirati F, Colivicchi F, Velardi A, Santini M. Prevalence and correlates of syncope-related traumatic injuries in tilt-induced vasovagal syncope. *Ital Heart J* 2001;**2**:38–41.
16. Sheldon R, Connolly S, Rose S, Klingenhoben T, Krahn A, Morillo C et al. Prevention of syncope trial (POST). *Circulation* 2006;**113**:1164–70.
17. Aydin MA, Mortensen K, Salukhe TV, Wilke I, Ortak M, Drewitz I et al. A standardized education protocol significantly reduces traumatic injuries and syncope recurrence: an observational study in 316 patients with vasovagal syncope. *Europace* 2012;**14**:410–5.
18. Bartoletti A, Fabiani P, Bagnoli L, Cappelletti C, Cappellini M, Nappini G et al. Physical injuries caused by a transient loss of consciousness: main clinical characteristics of patients and diagnostic contribution of carotid sinus massage. *Eur Heart J* 2008;**29**:618–24.
19. Keramidaki K, Tsagari A, Hiona M, Risvas G. Osteosarcopenic obesity, the coexistence of osteoporosis, sarcopenia and obesity and consequences in the quality of life in older adults ≥ 65 years-old in Greece. *J Frailty Sarcopenia Falls* 2019;**4**: 91–101.
20. Cao J, Wang T, Li Z, Liu G, Liu Y, Zhu C et al. Factors associated with death in bedridden patients in China: a longitudinal study. *PLoS One* 2020;**15**:e0228423.
21. Viljanen A, Salminen M, Irjala K, Korhonen P, Wuorela M, Isoaho R et al. Frailty, walking ability and self-rated health in predicting institutionalization: an 18-year follow-up study among Finnish community-dwelling older people. *Aging Clin Exp Res* 2020; doi: 10.1007/s40520-020-01551-x.

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Simultaneous pacing of left anterior/posterior fascicular areas as an alternative to left bundle branch pacing: a case report

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A 68-year-old man, who underwent a mechanical aortic valve replacement, was diagnosed with heart failure, complete atrioventricular block, and right ventricular (RV) escape rhythm. After admission, left bundle branch pacing was planned. However, due to the influence of the mechanical aortic valve, it was failed. In the end, in order to stay away from the scar under the metal valve, simultaneous pacing of left anterior fascicular area (LAFa) combined with left posterior fascicular area (LPFa) for treatment was proposed. Under the guidance of a C315-His sheath, two 3830-69 electrodes were successfully rotated into the LAFa and LPFa (Panel A, Marks 3 and 4), and the ECG of right bundle branch pattern was obtained (Panel B). The threshold of LAFa pacing and LPFa pacing were 1.0V/0.5 ms and 0.7V/0.5 ms, separately (Panel B). Then the right atrial electrode of Medtronic 5076-58 was implanted. The LAFa, LPFa, and right atrial (RA) electrodes were separately connected to the RV, left ventricular, and RA port. Finally, Medtronic C2TR01 was implanted successfully. At follow-up 6 months later, the pacing lead parameters were stable, and the patients' daily activity endurance increased significantly. The left ventricular ejection fraction increased to 51% at 6 months' follow-up (which is 31% before operation). The left ventricular end-diastolic diameter notably decreased from 69 mm to 59 mm, N-terminal pro B-type natriuretic peptide reduced from 2650 ng/L to 450 ng/L.

The full-length version of this report can be viewed at: <https://www.escardio.org/Education/E-Learning/Clinical-cases/Electrophysiology>.

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