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REVIEW

Delirium in Vascular Surgery

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Delirium is common in many surgical settings. Patients undergoing elective vascular surgery may be at particular risk of developing delirium, and may have modifiable aetiological factors that can be addressed by pre-operative interventions. We decided to review the literature regarding the incidence and aetiology of delirium in elective vascular surgical patients.
***Methods**. We searched medical databases, journals and bibliographies to identify relevant studies. We used predetermined quality criteria for appraisal of the quality of incidence and aetiological studies.*
***Results**. Four studies were identified as relevant to the review. The incidence of delirium ranged from 29.1% to 39.2%. The significant aetiological factors identified were age, pre-operative cognitive impairment, depressive symptoms, inter-operative blood transfusion and previous amputation.*
***Conclusions**. Delirium is common in people undergoing elective vascular surgery. Further research is required to examine the effect on outcome of delirium, and the effect of psychiatric and geriatric medicine interventions in this setting.*

Keywords: Delirium; Vascular surgery; Incidence; Aetiology.

Introduction

Delirium is a syndrome characterised by disturbance of consciousness, impaired attention or concentration and associated problems with memory, behaviour and the sleep-wake cycle.[1] It is a common and serious problem in hospitalised patients, particularly in older people.[2] Studies on delirium reveal prevalences of about 20% in medical settings rising to 83% in those receiving intensive care[3] and to 61% after hip fracture.[4] However, there is good evidence that delirium is often not detected by wards staff, with as many as 50% of cases going unrecognised.[4] In many inpatient populations delirium has an adverse effect on several important outcomes such as length of stay, mortality and instituitionalisation.[2] A better understanding of the aetiology and management of delirium in particular populations may improve these outcomes by improving the prevention of incident delirium and reducing the severity of prevalent delirium.

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The common elective vascular procedures are major operations including abdominal aortic procedures (open aortic aneurysm repair, open bypass for aorto-iliac disease), carotid endarterectomy, lower limb bypass grafts and above or below knee amputation.[5,6] Patients undergoing elective vascular surgery may be at increased risk of developing delirium since they are old and often have coexistent cerebrovascular disease, both of which are risk factors for delirium in other populations.[2] The elective nature of the procedures means that if modifiable risk factors can be detected, or vulnerable groups at significant risk can be identified, interventions can be targetted at them. In this systematic review we critically appraise the literature on the incidence and aetiology of delirium in elective vascular surgical population.

Methods

Literature search

Medline, Embase, Psychinfo and CINAHL were searched for relevant articles published from 1950 to August 2005, 1974 to August 2005, 1806 to August 2005 and 1982 to August 2005 respectively. A combination

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of MeSH terms and text words with appropriate use of wild cards and synonyms were used to identify potentially relevant studies. Details of the complete search strategy are available from the authors. The bibliographies of original articles were searched for additional references. The journals Annals of Surgery, European Journal of Vascular and Endovascular Surgery and British Journal of Surgery were hand searched from 1995 to August 2005.

Articles identified as relevant based on examination of the title and abstract were retrieved for further evaluation. All retrieved articles were screened using predefined eligibility criteria listed below. There were no language restrictions applied to the selection of studies.

Inclusion criteria for incidence

We included studies in the review if they met the following predefined eligibility criteria: participants who underwent elective vascular surgery; use of an acceptable definition of delirium (either recognised diagnostic criteria such as ICD-10[1] or DSM-IV[7] or a validated diagnostic tool such as the Delirium Rating Scale[8] or the Confusion Assessment Method[9]); reporting of original data on the incidence of delirium.

Inclusion criteria for aetiology

As well as meeting the above criteria, aetiological studies had to measure and adjust for appropriate confounding variables by multivariate logistic regression or other appropriate statistical techniques.

Study quality assessment

The quality of the studies was assessed by a predetermined check list produced by a critical appraisal skills programme.[10]

Abstraction of data

We extracted the following data from included studies: information on study design; population; sample size; selection criteria; diagnostic method; aetiological factors; and incidence of delirium. Data extraction was carried out independently by the authors, blind to each others findings.

Results

The literature search yielded 204 potentially relevant studies of aetiology and incidence of delirium of which 198 were excluded after screening their abstracts. No additional studies of potential relevance were found by hand searching or bibliography searching. Six studies were retrieved for detailed evaluation.[11–16] Two studies were further excluded for the following reasons; one study[14] reported prognostic data from the same cohort reported used by another study of incidence and aetiology and one study[15] was a duplicate of a second study leaving four studies to be included in the review.

All the four included studies described incidence and three of them also described aetiology. They involved a total of 364 participants of whom 130 developed delirium. Three of the studies were from the same research group.[12,13,16] In all the four studies the participants were followed up over the first seven postoperative days. The Diagnostic and Statistical Manual of Mental Disorders IV and Delirium Rating Scale[17] were used as the case detection method in all the three German studies[12,13,16] whilst the Japanese study[11] used the Confusion Assessment Method[11] as the case detection method. The Japanese study measured preoperative cognitive status using the revised version of Hasewaga's dementia scale[18] whilst the German studies used the Mini-Mental State Examination.[19] Preoperative depressive symptoms were measured with the Hamilton Depression Scale[20] in the German studies.

A summary of the studies on incidence and aetiology is shown in Tables 1 and 2. This review yielded a pooled incidence of delirium of 35.85%. Eleven significant aetiological factors were identified by multivariate analysis.

Discussion

This review has the following limitations. Due to a small number of studies being identified, publication bias and heterogeneity were not formally assessed.

We employed a systematic search strategy to detect relevant studies, meaning that we are unlikely to have missed important studies from this review. We employed recognised critical appraisal tools to determine the quality of studies and excluded those studies which did not meet out criteria. We therefore believe our findings to be a reflection of the literature in this area. It is worth noting that three of the four studies were from the same research group, which may limit further the generalisability of our findings. Also, only one study[11] employed a consecutive sampling method, and the other three studies[12,13,16] used neither consecutive nor random sampling method to identify participants, meaning that selection bias is a potential limitation in all the studies.

Table 1. Studies on incidence of delirium in elective vascular patients

Study	Country	Design	Case-finding instrument	Type of surgery	Sample size	% of potential sample	Mean age (yrs)	Cases	Incidence
Bohner *et al.* 2000	Germany	Prospective Cohort	DSM-IV, DRS ≥12	aortic, carotid, peripheral bypass	54			21	38.9%
Sasajima *et al.* 2000	Japan	Prospective Cohort	HDS-R-<20*, CAM**	Limb bypass	110			32	29.1%
Schneider *et al.* 2002	Germany	Prospective Cohort	DSM-IV, DRS ≥12	aortic, carotid, peripheral bypass	47	78.3	66.8	17	36.2%
Bohner *et al.* 2003	Germany	Prospective Cohort	DSM-IV,[a] DRS ≥12[aa]	aortic, carotid, peripheral bypass	153			60	39.2%

** Confusion Assessment Method.
[aa] Delirium Rating Scale.
* Hasegawa's Dementia Scale.
[a] Diagnostic and Statistical Manual of Mental disorders.

Despite these concerns, the rates of delirium we report in this review are in keeping with the overall rates of delirium in the postoperative period in other surgical populations.

Eleven significant aetiological factors were identified by multivariate analysis. Age and intraoperative excess blood transfusion have been identified as aetiological factors in studies on post-cardiotomy delirium[21,22] and this has been replicated in this review. Increased age, preoperative parameters such as cognitive impairment and depressive symptoms identified in orthopaedic studies[23] have been further replicated in this review. Stratification of the sample on basis of age was not employed in any of the four studies included in the review.

The study by Schneider *et al.*[12] included subjects of younger age (53–84 years old). The younger subjects are likely to have reduced comorbid factors when compared with the older subjects (>60 years old) who were included in the remainder of studies. Only the study by Sasajima *et al.*[11] generated odds ratios with confidence interval in its findings on aetiological risk factors for delirium. The wide confidence intervals reported are likely to be due to the small sample size. The study by Bohner *et al.*[13] on the findings on aetiology of delirium has unusually high odds ratio for some factors (e.g 28 for cognitive impairment and 24.4 for previous amputation) which would alert us to interpret the results with caution.

The results of this review could not be combined in a formal metaanalysis due to variation between studies in participants age, type of surgery case-finding method, and difference in confounding variables measured.

Table 2. Findings on aetiology of delirium from multivariate analysis

Study	Aetiological factors	Odds ratio	ß	Confidence interval of odds ratio	*p* value
Bohner *et al.* 2003	Absence of supra aortic occlusive disease	6.73		–	0.001
	Absence of hypercholesterolemia	5.51		–	0.001
	History of major amputation	24.4		–	0.001
	Age over 64 years	3.03		–	0.018
	Height <170 cm	3.95		–	0.004
	HAMD >8*	2.43		–	0.066
	MMSE <25	28		–	0.001
	Intra operative need for colloid infusion >800 ml	2.62		–	0.035
	Intra operative minimal potassium <3.5 mmol/l	3.18		–	0.021
Schneider *et al.* 2002	Preoperative depressive symptoms HAMD[a]		0.05		0.0023
	MMSE[aa]		−0.08		0.0007
	Perioperative infusion		0.0001		0.0094
	Perioperative transfusion		0.0005		0.0069
Sasajima *et al.* 2000	Age >70 years	14.1		2.7–72.0	0.002
	Critical limb ischemia and ankle pressure mm40 Hg	3.8		1.3–10.9	0.013
	HDS-R* Score <20	3.3		0.8–13.5	0.093
	Operation time >7 hr	1.8		0.6–4.9	0.281
	Albumin <3.8 g/dl	1.9		0.5–7.0	0.330

[a] Hamilton Depression Scale.
[aa] Mini Mental State Examination.
* Hasegawa's Dementia Scale.

Our findings have important implications for care of the older vascular surgical patient. The incidence of delirium is high after vascular surgery and at-risk populations can be identified pre-operatively. However, the overall quality of the studies that we found was not as high as we would have liked, and in particular no studies employed survival analysis to examine the effect of multiple confounding variables on the development of delirium.

There seems to be a need for further research in this area, we need to know more about the prognosis of delirium if we are to understand the personal and organisational costs of a delirious episode after vascular surgery. We also need to clarify the aetiology of delirium in this population in order to develop protective interventions for those at risk, as has been carried out in other delirious populations.[24–26] Likely interventions may mirror those proposed in the hip fracture population,[27,28] where involvement of geriatricians and old age psychiatrists, using protocol-driven screening and management, may improve outcomes for all.

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