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Review Article

REVIEW ARTICLE

Clinical diagnostic tools for screening of perioperative stroke in general surgery: a systematic review

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Abstract

Perioperative stroke is a devastating complication that carries high mortality and functional disability. Unfortunately, residual anaesthesia and analgesia may obscure important warning signs and may lead to a delay in the assessment and treatment of major stroke after surgery. The purpose of this review is to examine the utility of existing stroke scales, for the recognition of perioperative stroke in the general surgical population. A total of 21 stroke scales have been described in the literature. Diagnostic performance was reported in 17 scales. The majority of the stroke scales were designed to evaluate current neurological deficits after an established stroke event. Recent abbreviated stroke test, such as the Face, Arm, Speech Test (FAST), were developed to facilitate stroke identification in the emergency department. Only two stroke scales have been applied in the perioperative setting after cardiac, carotid and neurological surgeries. The modified National Institutes of Health Stroke Scale appears to be useful in detecting new subtle neurological deficits in critical care, or high dependency units after surgery. However, in the general postsurgical wards, given the concern about the workload required, abbreviated stroke tests may be more appropriate for routine regular stroke surveillance. It is hoped that these tests will provide rapid assessment of global neurological function to facilitate timely diagnosis and treatment of perioperative stroke.

Key words: diagnosis: screening; diagnostic tests; perioperative period; stroke

Perioperative stroke is a cerebrovascular event that occurs during and up to 30 days after surgery.[1] Depending on the type of surgery and patient characteristics, the incidence of perioperative stroke varies between 1.4–9.7% after cardiac operation,[2 3] 2.9–7.4% after carotid artery surgery[4] and 0.05–4.4% in the general surgical population.[1 5 6] The outcome after perioperative stroke is usually disabling and/or fatal.[7 8] A quarter to half of patients die within 30 days of perioperative stroke, and in the remaining patients, half were left with major disability that adversely affected their quality of life.[7 8] This is in striking contrast to the outcome after non-operative stroke. In a meta-analysis of six randomized controlled trials of thrombolysis for acute stroke, mortality was 13% and major disability was reported in 26% of all survivors.[9] Although systemic inflammatory responses triggered by surgery, inability to initiate thrombolytic therapy and different types of stroke may all exacerbate cerebral injury,[1 10 11] a delay in the recognition and assessment contributes to the higher morbidity and mortality.[1 12] In this regard, residual anaesthetic and analgesic effects may obscure important warning signals of major stroke, as may delirium and other confusional states.[13 14] Similarly, limb weakness may be

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confused with primary orthopaedic injury.[15] In a recent analysis of the Ontario Stroke Registry, a long delay in stroke recognition was thought to contribute to worse outcomes among patients with in-hospital stroke compared with those with community-onset stroke.[16] These data suggested that a valid stroke scale that allows medical and nursing personnel to easily recognize stroke might facilitate early appropriate neurologic referral and initiation of timely treatment. The aim of this article is to review the utility of existing stroke scales for screening and recognition of perioperative stroke in non-neurosurgical patients.

Stroke scales

Stroke scales were developed to standardize neurological evaluation in clinical trials.[17] Currently, two types of stroke scales are available. The stroke assessment scale aims to evaluate current cognitive and physical impairment. On the other hand, the stroke outcome scales, such as the Barthel index,[18] are designed to determine the impact of strokes on daily activities and quality of life during stroke rehabilitation. The stroke assessment scale should also facilitate identification of new neurological deficits and it is the focus of this review.

Table 1 shows the features of an ideal stroke assessment scale for perioperative use. Despite distracting factors in the perioperative period, it should be able to detect neurological deficits after a cerebrovascular event (content validity), and simple to use for non-specialist physicians, junior medical, nursing and paramedic staff. It should be quick to administer and the scores should be consistent among observers (inter-rater reliability). In this article, we assessed the currently available stroke assessment scales using these criteria.

Search methods

In order to identify all forms of stroke scales reported in the literature, we searched the Ovid version of MEDLINE, EMBASE, CINAHL, PsycINFO, the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews. In addition, we reviewed the reference lists from articles retrieved and those in recently published stroke trials. We used a number of search terms including stroke or cerebrovascular accident, clinical assessment tool, diagnostic scale, neurological scale and detection scale. A total of 3,062 articles were retrieved. After initial screening of titles and abstracts, 2,819 studies were removed because they were commentary or review, or they did not report a stroke assessment scale. Of the 243 articles that we retrieved for full text evaluation, 21 stroke assessment scales were identified. Table 2 reports the diagnostic performance of these stroke scales.[19–51]

Table 1 Features of ideal stroke assessment scale

- Easy to administer
- Quick
- Detect neurological deficits after a cerebrovascular event after surgery (validity)
- Distinguish distracting factors, such as residual anaesthetic, analgesic effects from serious symptoms and signs of perioperative stroke
- Simple to use for non-specialist physicians, junior medical, nursing and paramedic staff
- Consistent scores among observers (inter-rater reliability)

Neurologic grading system for acute strokes

The first system was developed by Gilroy and Meyer in the 1960s and was subsequently modified by Tuthill and co-workers to determine the severity of neurological deficits in patients with acute stroke.[52 53] There are 5 items in the scoring system (mentation, motor weakness, cranial nerve palsy, sensory deficits and abnormal reflexes). Diagnostic performance of the system was not reported.

Fugl-Meyer assessment scale

The Fugl-Meyer Assessment is an impairment index of motor and joint functioning, balance, and sensation in hemiplegic patients after stroke.[54] The scale is comprehensive and the full scale contains 155 items. A trained person requires at least 35 min to complete the assessment. Selective evaluation of the upper or lower limbs motor function, using parts of the scale are commonly performed. Although the diagnostic characteristics of the Fugl-Meyer assessment scale have been widely reported in stroke rehabilitation,[19 20 55] there is no study evaluating the utility of this scale to detect acute stroke.

Oxbury initial severity scale

The Oxbury scale was developed to predict outcome after stroke.[56] It is designed to be administered by neurologists. The full scale has 52 items including level of consciousness, gaze palsy, limb weakness and visual field defect. There are no data on the diagnostic and predictive performance of the scale.

Mathew stroke scale

The Mathew stroke scale is one of the earlier tools to measure severity of stroke in clinical trials.[57] The scale was designed for use by neurologists. It is a comprehensive scale that consists of seven major assessment categories (mentation, cranial nerves deficit, motor power, reflexes, sensation and disability status scale). Internal consistency was modest (Cronbach's alpha=0.54).[21] There were also problems with inter-rater reliability. In a study of 12 stroke patients reviewed by four senior neurologists using the Mathew stroke scale, scores from a number of items in the scale varied enormously, Cohen kappa values for level of consciousness, orientation, visual field defect, gaze palsy and facial weakness ranged from 0 to 0.19, indicating poor agreement between observers.[58]

Toronto stroke scale

The Toronto stroke scale was developed for evaluating steroid therapy in an acute cerebral infarction trial.[59] It contains items on level of consciousness, mental status, motor and sensory deficit in the limbs, aphasia, hemianopsia, cranial nerve deficits, gaze palsy and higher cortical functions. Scores from the Toronto stroke scale (ranges from 0–155) correlated with clinical observation on the severity of stroke (n=42, Spearman's rho=0.87).[60]

Copenhagen stroke scale

Copenhagen stroke scale is a 10-item scoring system to estimate the initial severity of stroke.[61] A modified version is available with revised scoring definition. The scale was the primary outcome measure in the Copenhagen Stroke Study.[61] There are no data on the predictive performance of the scale.