Defining Neuropsychological Impairment: Should We Abandon the "20% of Tests" Rule?

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Introduction. Neuropsychological impairment after cardiac surgery is defined as a decline (20%, 0.5 SD, or 1 SD) on 20% of tests. This definition implies that all neuropsychological tests are equally important and equally responsive (ie, equally likely to show change). We hypothesized that psychometric tests are not equally responsive after cardiac surgery.
Methods. We administered a battery of 11 neuropsychological tests preoperatively and 3 months postoperatively to 172 coronary bypass patients as part of an ongoing clinical trial. We compared test responsiveness using standardized response means, defined as the change in score divided by the standard deviation of the difference scores. The clinical trial was approved by our Internal Review Board and all patients gave written, informed consent.
Results. Standardized response means, with higher values representing more improvement postoperatively, for each test were: Rey Visual Design Learning Test, −0.07; Verbal Fluency, −0.04; Rey Auditory Verbal Learning Test, −0.01; Visual Span, 0.06; Digit Span, 0.06; Grooved Pegboard, 0.10; Trail Making B, 0.21; Mental Control, 0.22; National Adult Reading Test, 0.23; Speed and Capacity of Language Processing test, 0.38; Trail Making A, 0.48.
Conclusions. Neuropsychological tests have marked variation in their ability to detect change after cardiac surgery. Such variability brings into question the validity of the "20% of tests" rule. Test responsiveness variability can be partially accounted for by using weighted scores or factor analysis.

Power M-Mode Doppler Is Sensitive to Microemboli, Whereas M-Mode Color Velocity Imaging Is Not

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Introduction. Power M-mode Doppler (PMD) is a new modality for observing microembolic (ME) signatures and blood velocity, with depth on the vertical axis, time on the horizontal, and power as directional color intensity. In this work, traditional M-mode color velocity (MCV) imaging and PMD data were simultaneously acquired and explored for sensitivity to passage of microemboli through cerebral arteries.
Methods. A 2-MHz Doppler (Spencer Technologies TCD 100M) was used with sample gates at 2-mm intervals from 28- to 92-mm depth, 8-kHz pulse repetition frequency, and 6-mm sample volume. PMD and MCV lines were constructed every 8 msec, using all 33 sample gates, and connected to respectively construct the PMD and MCV images. The spectrogram from a gate depth in the middle cerebral artery was concurrently displayed. ME signals were collected from a subject with aortic and mitral St. Jude mechanical valves.
Results. ME signals were observed as high-power tracks in the PMD image, and were virtually undetectable in the MCV image. Close inspection showed that the embolus velocity dominated the MCV image during and in the vicinity of embolus passage, but this is a subtle effect. Many PMD ME signals did not appear in the vicinity of the spectrogram gate depth, and as well, did not appear in the spectrogram.
Conclusions. PMD shows ME as high-intensity tracks, whereas MCV is insensitive to the same events. PMD can be used to observe ME over greater territory than covered by the single-gate spectrogram. PMD comprises a nonspectral indicator of ME that has potential for automatic embolus detection.

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The Risk of Cognitive Decline After Not Undergoing Coronary Artery Bypass Grafting: Preliminary Results

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Introduction. Cognitive decline (CD) has been recognized as a major complication after coronary artery bypass grafting (CABG) [1]. The aim of the present study was to explore the incidence of CD in a healthy control group.
Methods. Informed consent and institutional approval for the study were obtained. A battery of seven neuropsychological tests (Rey Auditory Verbal Learning Test, Trailmaking Tests A and B, Grooved Pegboard, Symbol Digit Modalities Test, Letter Cancellation Task, Stroop Test, Self Ordering Tasks) was administered twice to a group of healthy middle-aged controls (N = 109, mean age 60.5 years) with a time interval of 3 months. The incidence of CD was determined by two commonly used definitions. (1) one standard deviation decline in 20% of the tests (1 SD); and (2) 20% decline in 20% of the tests (20%).
Results. A preliminary analysis (N = 64) revealed an incidence of cognitive decline of 9.4% using the 1 SD definition, and 21.9% according to the 20% criterion.
Conclusions. The observed incidence of cognitive decline using two generally accepted definitions in a healthy control group is comparable with the incidence reported in a number of CABG studies [2]. We therefore conclude that the incidence of cognitive decline in CABG patient populations based upon the described definitions cannot only be attributed to the surgical procedure.

References

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Multifrequency Doppler Discriminates Between Baseous and Solid Microemboli

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Background. Brain injury remains a significant sequela of cardiopulmonary bypass (CPB) surgery despite improvements in CPB apparatus and refinements in surgical techniques. Cerebral microemboli have for a long time been a suspected cause of post-CPB cerebral dysfunction. Their exact clinical significance has, however, been difficult to assess due to the fact that we have not had methods that can determine if they are solid or gaseous. Theoretically, this is possible by insonating an embolus simultaneously with two different ultrasound frequencies because the reflected ultrasound power will differ for each frequency depending on embolus type. Solid microemboli reflect more ultrasound power at a higher frequency, whereas the opposite is true for gaseous microemboli.
Methods. The Doppler instrumentation (EmboDop) discriminates between solid and gaseous microemboli by insonating them simultaneously with 2.0- and 2.5-MHz frequencies. In the experimental part of the study, 61 solid (50 to 80 μm plastic) and 45 gaseous (15 to 30 μm) were introduced into a pulsatile closed-loop system. Ten prosthetic heart valve patients and 35 carotid artery stenosis patients took part in the clinical studies.
Results. In the experimental study, analysis of the reflected Doppler power for the two different ultrasound frequencies showed correct differentiation between solid (N = 61) and gaseous (N = 45) microemboli for 95% of the microembolic events. Five hundred and sixty-six microemboli in the 10 prosthetic heart valve patients and 21 microemboli in 11 carotid stenosis patients were analyzed. In the prosthetic heart valve patients, 478 (84.4%) were gaseous and 88 (15.6%) solid, whereas all 21 (100%) microemboli in the carotid stenosis patients were solid.
Conclusions. These studies have shown that it is now possible to discriminate between solid and gaseous cerebral microemboli. This new method is now being assessed during CPB surgery.