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Psychological Alterations After Anesthesia and Surgery

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The degree and significance of postoperative mental changes caused by surgery and anesthesia are still debatable. However, after open heart surgery and after extensive surgery on elderly patients, long-lasting mental changes do occur. The susceptibility of older people to such cerebral damage may be due to preoperative marginal circulation in parts of the brain, and a small reserve of functioning neurones compared to younger patients.

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Patients admitted to the hospital for surgical procedures often have anxiety about the operation and the outcome, and psychological alterations secondary to this are often encountered in the postoperative period.

In elderly patients, hospitalization alone often leads to mental changes, possibly due to change of environment.[1]

Evaluation of the effect of anesthesia and surgery on psychological and mental functions is difficult, and conflicting results from clinical studies are, therefore, not surprising.

Bedford[2] described 410 patients who "had never been the same since operation" and 18 cases of gross dementia occurring, in 1193 patients above 50 years of age, after anesthesia and surgery. These findings stimulated Simpson and co-workers[3] to investigate the social and mental integrity of 741 patients above 65 years of age admitted to their hospital for elective surgery in one year. Of these patients, 12% were found to lead "limited" or "much limited" existences after surgery. However, except for four cases, these deteriorations were not due to organic cerebral damage and could be explained by identifiable reasons unrelated to the anesthetic procedures used.

In a recent study,[4] we found significant mental disorders in 7 of 31 elderly patients operated on for total hip arthroplasty under general anesthesia. In contrast, 29 patients operated on for the same procedure under epidural anesthesia, showed no mental changes postoperatively (Table 1).

However, in a still unpublished study by Riis *et al.*[5] investigating mental disorders in a similar population after total hip replacement, the mental disorders were transient, and there was no difference between the epidural, the general anesthesia, or the epidural/general anesthesia combined group.

The possible causes of mental disorders acquired during anesthesia and surgery are shown in Table 2. The occurrence of cerebral hypoxia is probably of major importance. Severe general hypoxia during and immediately after surgery is usually caused by anesthetic accidents or serious complications. However, less pronounced hypoxia is more likely to occur, and is, in fact, found postoperatively after different surgical procedures. Figure 1 shows the changes in PaO_2 after total hip arthroplasty. This reduction in PaO_2 does not seem alarming, but might cause cerebral dysfunction in elderly patients in whom regional cerebral blood flow prior to operation may be marginal.

The effect on brain functions of hypotension

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Table 1. Mental Changes After Total Hip Arthroplasty

	Total Patients	Patients with Postoperative Mental Disorders
General anesthesia	31	7
Epidural anesthesia	29	0

Table 2. Possible Causes of Mental Disorders Acquired During Anesthesia and Surgery

Cerebral hypoxia
General hypoxia
Hypotension
Hypocarbia
Microembolisation
Extracorporal circulation
Thromboplastine activation
Effects of anesthetic agents
Unblocked surgical "stress"

to 50 mm Hg mean arterial pressure during total hip arthroplasty has been studied by Thompson and coworkers.[6] Only one of 21 patients became disoriented during the first 24 hours after operation and all subsequently recovered. The remaining 20 patients showed no intellectual or neurologic alteration. However, Berg, Nilsson, and Vinnars[7] found, in approximately 50% of the patients undergoing hypotensive anesthesia, a positive hexobarbitone critical flicker fusion test, indicating a diffuse cerebral injury, which persisted for more than six days. They also concluded that males were more vulnerable than females, and patients with advanced cancer were particularly vulnerable. A decrease of blood pressure to 80 mm Hg in combination with elevation of the head also increased the risk of cerebral injury.

Hyperventilation with lowering of $PaCO_2$ is known to cause cerebral vasoconstriction and reduced cerebral blood-flow. The dissociation of oxygen from the hemoglobin is also reduced, tending to increase the cerebral tissue hypoxia. The possible importance of these factors in causing postoperative cerebral injury has been the subject of several investigations. Allan and Morris,[8] using the same test as Berg and coworkers,[7] could show that, of 18 patients subjected to hyperventilation during anesthesia, 14 had positive tests for cerebral cortical dysfunction. However, these effects were of short duration, and were normalized within one to three days postoperatively.

In contrast, Whitwam and co-workers[9] found no cerebral changes in healthy young volunteers passively hyperventilated for two hours using the hexobarbitone critical flicker fusion test. Using psychometric tests involving memory and learning processes, Murrin and Nagarajan[10] found a slight functional impairment in the hyperventilated group which was not statistically different from the normal ventilated group.

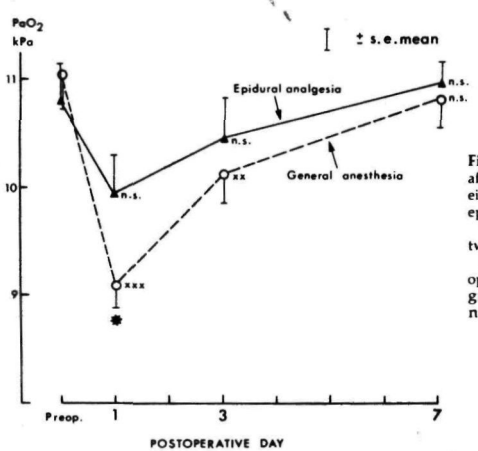

Fig. 1. Change in arterial oxygen tension after total hip arthroplasty performed under either general anesthesia (n = 31) or epidural anesthesia (n = 29).

Significance of difference between the two groups: * = $p < 0.025$.

Significance of difference between postoperative and preoperative PaO_2 in each group: xxx = $p < 0.001$, xx = $p < 0.01$, n.s. = not significant.