

visible fasciculations and EMG activity. The biceps brachii muscle, which was utilized in most of our work, was considered a white, fast-acting muscle, sensitive to SCH depolarization and fasciculation in virtually all individuals.

In conclusion, if a closer association between fasciculation activity and changes in intragastric pressure is to be demonstrated, it may be necessary to measure directly the EMG potentials arising from deeper abdominal muscles, including the diaphragm. This will necessitate the use of needle-electrodes.

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In reply:—Our study “Succinylcholine-induced fasciculations and intragastric pressure during induction of anesthesia,” obviously has generated discussion regarding both the methodology and the underlying physiology. Regarding the comments of Professor Smith, the purpose of our study was to examine the relationship between abdominal muscle fasciculations and intragastric pressure. We do not dispute the importance of the barrier function of the lower esophageal sphincter in preventing gastric reflux, but our study was designed to test the assumption that gastric pressure *per se* is influenced by the activity of the overlying abdominal muscles. Of particular interest is the fact that in Dr. Smith’s own published observations¹ he demonstrated a rise in intragastric pressure at the height of the succinylcholine-induced muscle fasciculations. Although Dr. Smith concludes that the corresponding increase in esophageal sphincter tone is adequate to compensate for the gastric pressure changes and maintain an effective barrier function, there is no evidence, to my knowledge, that this maintenance of barrier function can be assumed to be operative in patients with gastric or intra-abdominal pathology. It is precisely this type of patient who is at greatest risk and for whom the classical rapid sequence induction is performed. In the interest of safety, I cannot assume that “pretreatment with a nondepolarizing muscle relaxant is unnecessary,” but I would certainly be prepared to modify this opinion if and when data are available showing retention of effective barrier function in all patients under all circumstances.

The comments of Collier regarding the methodology

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also require reply. There is little point in discussing the magnitude of recorded IEMG values from the *biceps brachii*, because our intent was to quantify *abdominal muscle* activity coincident with intragastric pressure changes to test the assumption that there was a direct relationship between these two phenomena. Our demonstration of a highly significant correlation between Δ IGP and Δ IEMG (fig. 1, page 182)² substantiates our methodology. We chose the 20-s sampling period because continuous recording of IEMG activity in our patients indicated that this interval was the most appropriate for observing the responses in which we were interested. Certainly, one would expect a different temporal relationship between fasciculation and injection time in other parts of the body. The wave-like spread of fasciculations over the body musculature is a phenomenon observed daily. Finally, it is of interest that Dr. Collier was able to demonstrate “almost complete” abolition of succinylcholine-induced IEMG fasciculation activity following pretreatment, and we were able to demonstrate, similarly, that the incidence of significant IEMG increase was reduced from 32 per cent to nil by pretreatment. I see no discrepancy in our data and no misleading or ambiguous results.

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An Unusual Complication Following Cannulation of an External Jugular Vein

To the Editor:—There have been several cases of internal jugular and subclavian venous thrombosis produced by cannulation of the central venous system.^{1,2} The present case report describes the occlusion of an external jugular vein after percutaneous cannulation and the subsequent surgical complication which resulted.

REPORT OF A CASE

A 76-year-old woman with a history of heavy snuff usage was admitted to the hospital for evaluation of dysphagia. Her past history was significant in that she had had a tumor of the tongue which required a hemiglossectomy and right radical neck dissection during which a portion of the right internal and external jugular veins were surgically removed. One year prior to the current hospitalization, the patient had a second oral tumor removed from the left alveolar ridge. Diagnostic procedures on this admission confirmed the presence of a carcinoma of the floor of the mouth and a total laryngopharyngectomy with a free jejunal graft for replacement of the cervical esophagus was planned.

Preoperatively, the left external jugular vein was cannulated percutaneously and a 16-gauge catheter (Arrow Central Vein Catheterization Kit #AK-04200) was advanced into the central venous system. The patency of the catheter was maintained with intermittent boluses of normal saline containing 2 units/ml heparin. An appropriate pressure waveform was transduced from the central venous catheter. After an awake oral intubation, anesthesia was induced with 200 µg fentanyl and 125 mg sodium thiopental injected through a peripheral intravenous catheter. Anesthesia was maintained with enflurane, nitrous oxide, and oxygen. After the total laryngectomy and pharyngectomy had been performed, a short segment of jejunum was taken to replace the resected cervical esophagus. The artery from the jejunal graft was to be anastomosed to a thyroidal artery while the vein would be connected to the left external jugular vein with an end-to-side anastomosis. When the surgeon realized that the left external jugular vein had been cannulated, the catheter was removed and external pressure applied to the skin. This occurred approximately 4.5 hours after the insertion of the central venous line. The surgical procedure then continued and the appropriate arterial and venous anastomoses were made. The jejunal graft appeared viable at the end of the procedure and the patient recovered from the anesthesia without incident.

Twelve hours later, the jejunal graft was noted to be engorged and cyanotic and the patient was returned to the operating room for re-exploration of the neck. The jejunal graft was non-viable although there appeared to be no occlusion of the arterial supply. Further examination revealed that the external jugular vein was thrombosed distal to the anastomosis with the jejunal vessels and that this was responsible for the failure of the graft. A new section of jejunum was removed from the abdomen and was used to replace the non-viable graft. The

arterial anastomosis was made to the same thyroid artery as was used previously, but the venous anastomosis was made to the left internal jugular vein. This jejunal graft remained viable and the patient recovered from the second procedure uneventfully.

Monitoring of the central venous pressure was indicated in this major surgical procedure. Because of the previous right radical neck dissection, the right internal and external jugular veins were unavailable for access. Thrombosis of central veins are a recognized complication of percutaneous cannulation.^{1,2} In the present case, thrombosis of the external jugular vein resulted in the failure of the first free jejunal graft. Two surgeons were involved in this procedure. The first performed the laryngopharyngectomy while the second was responsible for procuring and inserting the free jejunal graft. The choice of the external jugular vein for monitoring the central venous pressure was discussed preoperatively with the first surgeon but not the second. If it had been known that the surgical procedure utilized the one remaining external jugular vein, a different site would have been selected for a central venous catheter.

Although the incidence of venous occlusion is small when catheters are introduced into large veins with high flow such as the internal jugular or subclavian veins, it might be expected that thrombosis of external jugular veins may be more common because of their smaller size and lower flow rates. This case demonstrates the need for a complete understanding of the proposed surgery prior to the institution of intraoperative monitoring catheters and demonstrates a surgical complication which may have resulted from the placement of a central venous catheter in the external jugular vein.

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