

## Percutaneous Cannulation of the Internal Jugular Vein in Patients with Coagulopathies: An Experience Based on 1,000 Attempts

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Percutaneous cannulation of the internal jugular vein is a widely used route for insertion of a central venous or Swan-Ganz catheter. In this prospective study, we report our experience based on 1,000 attempts to cannulate the internal jugular vein in patients with coagulopathies.

### METHODS

From 1976 to 1980 percutaneous cannulation of internal jugular vein was performed in a 1,000 patients series to facilitate obtaining a transvenous liver biopsy.<sup>1</sup> All these patients had coagulopathies: bleeding time (Ivy) more than 10 minutes (normal: less than 10 minutes), and/or prothrombin time activity less than 50 per cent of normal (normal: 80-100 per cent), and/or a platelet count less than 50,000/mm<sup>3</sup> (normal: 200,000 to 400,000/mm<sup>3</sup>), and/or an euglobulin lysis time less than 2 hours (normal: more than 3 hours). These coagulopathies were related to liver failure and hematologic disorders in 96 and 4 per cent of the patients, respectively.

Meperidine, 50 mg, was given intramuscularly and the patients were positioned supinely with their heads rotated to the opposite side of the puncture site. After infiltration with 1 per cent lidocaine, the internal jugular vein, usually the right, was punctured with a 17-gauge needle attached to a 10-ml syringe containing 5 ml of saline. The usual puncture site (upper puncture site) was located on the neck, 4 cm below the angle of the mandible, at the inner border of the sternocleidomastoid muscle and on the outside of the common carotid artery. Then the needle was inserted under the sternocleidomastoid muscle, aiming at the junction of the middle and inner thirds of the clavicle, with a 45° posterior angle of entry with the skin; the puncture was considered successful when dark blood could be withdrawn. If the puncture was unsuccessful, another attempt was performed in another

puncture site, 3 cm above the clavicle, at the outer border of sternocleidomastoid muscle aiming at the suprasternal notch with a 30° posterior angle of entry with the skin (supravicular puncture site). In patients in whom puncture of the right internal jugular vein was not possible, left internal jugular vein was punctured at a symmetrical site. In order to introduce a catheter, a 40-cm long guide wire was inserted through the needle into the lumen of the vein. The needle was then withdrawn; the vessel dilator and the desilet sheath (Vygon-France) were inserted through a 3-mm long skin incision. The vessel dilator and the guide wire were removed and a 70-cm long catheter was then inserted through the desilet sheath into the lumen of the internal jugular vein and advanced into the hepatic vein under fluoroscopic visualization. Both desilet sheath and catheter were removed after a period lasting from 10-60 min; the time necessary to perform transvenous liver biopsy. In patients in whom puncture of both right and left internal jugular veins was not possible, another attempt was performed the next day after a parenteral infusion of 500 to 1,000 ml of a colloid solution. Number of thrusts and puncture sites were recorded for each patient.

### RESULTS

Puncture of the internal jugular vein was successful in 993 patients (table 1). In the 43 patients in whom puncture of the right internal jugular vein was not possible, but successful in the left internal jugular vein, 11 required an infusion of a colloid solution. In 573 patients, the puncture was successful with the first or second thrust (table 2); in 32 patients, six thrusts were performed at the same site without any complication. In 74 patients, common carotid artery was inadvertently punctured. A clinically detectable hematoma occurred in 10 patients; in one patient, the hematoma compressed the airway; this patient recovered completely after a surgical drainage. In this patient, puncture of the internal jugular vein was difficult because of a goiter, but the carotid artery apparently was not punctured; the hematoma was attributable to a venous blood effusion. No chronic hematoma was observed. A small apical right pneumothorax occurred in two patients by roentgenographic examination; there were no clinical symptoms; these two patients had been punctured at the upper site. A transient

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TABLE 1. Overall Experience with 1,000 Attempts to Cannulate Internal Jugular Vein in Patients with Coagulopathies

Procedure	Number of Patients
Right upper puncture site	790
Right supraclavicular puncture site	160
Left puncture sites	43*
Unsuccessful attempts	7

\* Including 11 patients punctured after infusion of a colloid solution.

Horner's syndrome was observed in two patients and disappeared within one month. A transient dysphonia occurred in one patient and disappeared within one week. No air embolism occurred.

### DISCUSSION

The rate of reported success in cannulation of the internal jugular vein in adults ranges from 75–99 per cent<sup>2,3</sup>; in most of the series the success rate is over 95 per cent<sup>3,5</sup> and even reaches more than 99 per cent in our series. The success rate apparently decreases as the number of thrusts increases<sup>2</sup> and, thus, attempts should probably cease if the first three attempts were unsuccessful. However, in our series, since in 3 per cent of patients internal jugular vein was only punctured after six thrusts at the same site without any complication, we feel that to abandon after three attempts is premature, particularly when the carotid artery has not been inadvertently punctured. When the puncture was unsuccessful at each of the puncture sites, it was still possible to increase the success rate with another attempt after increasing venous pressure and diameter with an infusion of a colloid solution and raising the lower extremities.

The most common reported complication of internal jugular vein cannulation is hematoma,<sup>2,6,7</sup> sometimes compressing the airway and needing a surgical drainage.<sup>5,8–10</sup> Thus, internal jugular vein cannulation has been reported contraindicated in patients with coagulopathies.<sup>6,10</sup> Since the biopsy needle is not very flexible, transvenous liver biopsy requires an almost straight line from the puncture site to the inferior vena cava; thus, in our patients, the only appropriate route is the internal

jugular vein, chiefly the right one. Many approaches of the internal jugular vein have been published.<sup>6</sup> In all of our patients, attempts to puncture the internal jugular vein at the upper site far from the clavicle were performed for two reasons: first to facilitate the application of pressure when the carotid artery was punctured; and secondly to prevent the risk of pleural puncture which can result in pneumothorax<sup>2,4–6</sup> or in hemothorax.<sup>11</sup> In our series, despite an arterial puncture rate of approximately 7 per cent, a severe hematoma was observed in only one patient. A prompt application of pressure when the carotid artery is punctured usually prevents a hematoma from being developed. The occurrence of a pneumothorax in two patients punctured at the upper site is not attributable to a direct pleural puncture with the needle. In these two cases, the internal jugular vein was easily punctured, but the needle was probably inadvertently shifted out of the lumen of the vein before inserting the guide wire; thus, the guide wire was advanced along the vessel and penetrated the pleura. When the dilatator and the desilet sheath were inserted, they could not be advanced correctly and blood could not be withdrawn; the procedure was stopped and roentgenographic examination showed small apical right pneumothorax. The occurrence of an Horner's syndrome in two patients may be related to a direct trauma with the needle or to pressure from a hematoma. Our patients, as others reported previously,<sup>7,12</sup> recovered completely.

We conclude that cannulation of internal jugular vein in patients with coagulopathies has a high success rate and does not result in severe complications. Therefore, it can reasonably be proposed as a usual route of catheter placement in such patients.

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TABLE 2. Number of Thrusts Necessary to Cannulate the Internal Jugular Vein in 1,000 Patients with Coagulopathies

Number of Thrusts	Number of Patients
1	433
2	140
3 or more	427*

\* Including 32 patients with six thrusts at the same site.

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## Airway Management during Anesthesia in Patients with Epidermolysis Bullosa Dystrophica

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Epidermolysis bullosa is a rare hereditary disorder characterized by bullae formation of the skin and of certain mucous membranes. The bullae may arise spontaneously or follow minor mechanical trauma. The disease has been classified on genetic, clinical, and histologic criteria into several distinct categories.<sup>1</sup> Among these are the dominant and recessive forms of epidermolysis bullosa dystrophica in which the bullae heal with scarring. The former is usually mild and the mucous membranes are only occasionally involved. In the severe recessive form the mucous membranes usually are involved and chronic scarring of the oral cavity can result in limited mouth opening and immobility of the tongue,<sup>2</sup> while esophageal bullae may lead to strictures. Concern has been expressed that the larynx may be similarly involved and the possibility of airway obstruction resulting from oropharyngeal and laryngeal bullae has led to avoidance of endotracheal intubation.

This retrospective report reviews the experience from The Hospital For Sick Children in managing the airway during anesthesia for 33 patients with epidermolysis bullosa dystrophica.

### PATIENTS AND METHODS

In the years 1958-1980, 33 patients aged from 3 days to 23 years (19 male, 14 female) with epidermolysis bullosa dystrophica have undergone anesthesia at the Hos-

pital for Sick Children. The anesthetic records and case notes were scrutinized to determine the method of anesthesia and to see whether any complications had arisen.

A total of 309 general anesthetics were given for 329 surgical procedures; dental surgery was combined with another surgical procedure on 20 occasions. Table 1 lists the procedures carried out and reflects the severe scarring and the esophageal and dental lesions commonly seen in these patients. The tracheostomy was carried out because of laryngeal edema in a patient referred for stridor and was not due to bullous formation in the larynx.

Anesthesia generally was induced with 50 per cent cyclopropane in oxygen or intravenous sodium thiopentone (4-6 mg/kg). Maintenance of anesthesia was with nitrous oxide, oxygen, and halothane breathed spontaneously through a modified Ayres T-piece or a Magill circuit (Mapleson A). The youngest patient, aged 3 days, was intubated awake for a gastrojejunostomy and using intermittent suxamethonium chloride, was ventilated with nitrous oxide and oxygen via a T piece.<sup>3</sup>

### RESULTS

#### *Airway Maintenance*

The airway was maintained during anesthesia by endotracheal intubation on 131 occasions, of which 113 were by the oral and 18 by the nasal route (table 2). Twenty-nine of the 33 patients were intubated at least once. An oropharyngeal airway with a Charles adaptor was used four times. A face mask was used 147 times, although it was stated on nine occasions that this was held clear of the face. Table 3 indicates the procedures in which intubation was performed. A gauze throat pack was used 18 times to prevent tracheal soiling during dental procedures.

Thirteen of the 33 patients who had at least one anesthetic had restrictive mouth opening due to scarring and contractures of the corner of the mouth. Six of these

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