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Tissue Adhesive in Bronchial Closure

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Monomeric *n*-butyl-2-cyanoacrylate was used in 25 patients undergoing pulmonary resections to strengthen the bronchial stump after pneumonectomy (n = 11) and to aid bronchial (n = 13) and tracheal anastomosis (n = 1) after sleeve resections. Neither group had any incidence of bronchopleural fistula. Bronchial anastomosis was accomplished in patients who underwent sleeve resection, reducing the number of sutures required to four apposing sutures, with the tissue adhesive ensuring an airtight closure. There was no incidence of bronchial stenosis. The efficacy of *n*-butyl-2-cyanoacrylate in preventing fistula formation after bronchial resections makes it an ideal agent in pulmonary surgery. Its use obviated the use of pedicled pleural flap, thus ensuring pleural integrity for extrapleural continuous intercostal nerve blockade for postoperative analgesia.

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Despite recent advances in the understanding of bronchial healing and refinement of surgical techniques, pneumonectomy still carries a risk of bronchopleural fistulization, resulting in multiple surgical procedures, prolonged hospital stay, and mortality rates of up to 20%. Sleeve resections, with their hand-sewn anastomosis, have a leak rate of 5%. A potentially serious complication of sleeve resection is bronchial anastomotic stenosis, which has been reported to affect 13% to 20% of patients. To avoid these complications of pneumonectomy and sleeve lobectomy, we used monomeric *n*-butyl-2-cyanoacrylate tissue adhesive in patients undergoing such procedures [1, 2] and followed them up prospectively [2].

One hundred eighty-seven consecutive patients underwent resection of pulmonary bronchogenic carcinoma with intraoperative application of monomeric *n*-butyl-2-cyanoacrylate glue from July 1987 through to December 1992 [2]. The glue reinforced either the stapled bronchial stump (135 patients), the sutured bronchial anastomosis in sleeve resections (37 patients), or the staple lines of wedge resections (15 patients). Mortality was 1.6% overall (3 of 187), and 5% among patients having pneumonectomies (2 of 40). Bronchopleural fistulas occurred in 0.5% (1 of 187) of all pulmonary resections and 2.5% of pneumonectomies (1 of 40). There was no fistula in the lobectomy or sleeve resection groups. Bronchial anastomosis was accomplished in patients who underwent sleeve resection with four uninterrupted apposing sutures and airtight closure ensured by the tissue adhesive. There was no incidence of bronchial stenosis. There were no cyanoacrylate adhesive-related complications. A follow-up of the patients up to 68 months has indicated not only its effectiveness but also its safety. Monomeric *n*-butyl-2-cyanoacrylate glue is safe, offers protection to bronchial margins, and may be valuable in preventing bronchial stenosis after sleeve resections.

We have also extended the use of monomeric *n*-butyl 2-cyanoacrylate glue for the endoscopic as well as intraoperative closure of postpneumonectomy bronchopleural fistulas [3, 4]. Our results confirm that bronchoscopic application of monomeric *n*-butyl 2-cyanoacrylate is simple and effective in closing the fistula and must be considered the method of choice for the initial treatment of these critically ill patients. This works by plugging the hole and thereafter producing permanent closure by an inflammatory or granulation tissue response to the glue. Once the fistula is closed the empyema cavity can be irrigated to supernatant sterility with antiseptic solution without fear of flooding the contralateral lung [3]. A similar principle has been applied to successful endoscopic closure of a late esophageal fistula after pneumonectomy [5].

Applying monomeric *n*-butyl 2-cyanoacrylate tissue adhesive is a simple and time-saving method of achieving airtight closure in a bronchial anastomosis and in reinforcing a stapled bronchial stump without interfering

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with healing. Our experience in using this tissue adhesive after pulmonary resections confirms the earlier experimental findings of its efficacy and lack of systemic toxicity.

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