To the Editor—Recombinant factor VIIa has recently been developed to reduce bleeding complications in hemophilic patients. After injury to the vessel wall, tissue factor (TF) is exposed to the circulating blood and forms complexes with already activated FVII (FVIIa). The complex TF-FVIIa initiates hemostasis at the site of injury by activating FX into FXa, thereby providing the first amount of thrombin.

It has been argued that FVIIa, in combination with extensive tissue damage, sepsis, and disseminated intravascular coagulation would be contraindicated. So far, there are few reports concerning rFVIIa treatment in situations of life-threatening bleeding caused by trauma, bowel surgery in patients with Crohn disease, and bowel lymphoma and profuse gastrointestinal bleeding. This report describes a patient successfully treated with rFVIIa in an attempt to control bleeding from necrotizing pancreatitis.

A 50-yr-old woman was admitted to our hospital with severe gallstone-induced pancreatitis. After initial treatment at the intensive care unit she developed necrosis and a pseudocyst of the pancreas. An attempt to drain this endoscopically resulted in massive hemorrhaging from the splenic artery. Immediate laparotomy was performed with repeated packing. She continued, however, to bleed. During reoperation the aorta was clamped and the diseased part of the pancreas resected. Furthermore, a subtotal gastrectomy, splenectomy, and ligation of the gastric and splenic arteries close to the aortic wall was performed. After declamping there was residual oozing from the region of the resected necrotic tissue that was covered with an omental patch. At the end of this second laparotomy she had received 19 l of packed red cells; 4.5 l fresh frozen plasma; 300 g of platelets; prothrombin complex concentrate 1,200, i.e., desmopressin 30 µg (Octostim®), Ferring Läkemedel AB, Limhamn, Sweden); antithrombin III 2,000; fibrinogen 1,000 mg; antifibrinolytic therapy with tranexamic acid 1 g; aprotinin 500,000/24 h infusion. Coagulation-fibrinolytic determination showed antithrombin III 47% (normal range > 50%), prothrombintime 32 s (normal range 10–12 s), APTT 35 s (normal range 26–36 s), fibrinogen 1.4 g/L (normal range 2–4 g/L), D-dimer 0.3 mg/ml (normal range < 0.3 mg/ml). She continued, however, to bleed and received another 8 l packed red cells during the next 11 h. She was in a state of circulatory shock.

In response to this uncontrollable hemorrhage a 120 µg/kg dose of recombinant factor VIIa (rFVIIa, NovoSeven®; Novo Nordisk, Bagsvaerd, Denmark) was given and repeated 5 h later. Bleeding decreased after the first dose and ceased after the second, without thromboembolic adverse effects. Coagulation and fibrinolytic parameters normalized. The patient and her hemoglobin stabilized with no recurrence of bleeding. She was reoperated 3 days later with evacuation of residual necrosis and hematoma and the Roux-en-Y gastric jejunostomy was reconstructed without any problems of coagulopathy.

The successful use of rFVIIa in this patient suggests that its use should be considered and studied in patients with massive bleeding from septicaemia when other standard therapy has failed.

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initial blood concentration, this side effect may play an important role for the future development of ultrashort-acting muscle relaxants.

Eckehard A.E. Stuth, M.D., Astrid G. Stucke, M.D., Mary A. Setlock, M.D. Department of Anesthesiology, Children’s Hospital of Wisconsin, Medical College of Wisconsin, Milwaukee Wisconsin. estuth@mcw.edu

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1. Naguib M. How serious is the bronchospasm induced by rapacuronium? ANESTHESIOLOGY 2001; 94:924–5

To the Editor.—Drs. Kron,1 Naguib,2 and Meakin3 discuss cases of bronchospasm associated with rapacuronium. Interestingly, all patients also received propofol. Dr. Kron also states in his discussion that propofol is “usually not associated with bronchospasm.” In the same issue of ANESTHESIOLOGY, Brown et al.4 describe that the metabisulfite preservative used in the newer formulation of propofol does not provide the attenuation in neurally mediated and direct airway smooth muscle-induced bronchoconstriction that is seen with propofol without metabisulfite. None of the reports of bronchospasm specified which formulation of propofol was used. While I believe that there is an association of bronchospasm with rapacuronium, the timing of the administration of propofol and rapacuronium warrants an examination of the propofol used. The release of propofol with metabisulfite in the Spring of 1999 may contribute to the observation of more cases of rapacuronium-associated bronchospasm than was seen during the period of the clinical trials.

In addition, Lewis et al.5 suggest that the propofol formulation with metabisulfite is less potent than the propofol formulation without metabisulfite. The metabisulfite containing propofol required 10% higher induction boluses and up to 25% higher infusion rates. This suggests that some patients may have been less deeply anesthetized before instrumentation of the airway. Also, while not evident in reading the case reports, there could have been a tendency to intubate prematurely in these patients, possibly contributing to bronchospasm.

In summary, I believe rapacuronium is associated with bronchospasm, although the contribution of propofol formulation and anesthetic depth at intubation is unknown. I suggest these factors need further investigation.

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2. Naguib M. How Serious Is the Bronchospasm Induced by Rapacuronium? ANESTHESIOLOGY 2001; 94:924–925


(accepted for publication November 30, 2001.)

In Reply.—The letter from Dr. Stuth et al. raises the ultimate question regarding the mechanism of rapacuronium-induced bronchospasm. They are, however, mistakenly implying that histamine release was suggested in my report as a possible mechanism.1 I have clearly stated that “…the bronchospasm noted with rapacuronium is mediated via mechanisms that do not seem to be related to histamine release.”2 The description of the three children who developed severe bronchospasm after rapacuronium by Dr. Stuth et al. is incomplete. It is, therefore, difficult to make any conclusions regarding rapacuronium-induced bronchospasm in these patients. It seems, however, that their third patient, who coughed during rigid bronchoscopy, might have had inadequate anesthesia. Therefore, it may be difficult to attribute the bronchospasm that occurred in this patient to the second dose of rapacuronium.

Dr. Stuth et al. suggested that “cholinergic facilitation”2 could explain the rapacuronium-induced bronchospasm. However, they did not specify which receptors needed to be invoked to activate this reflex mechanism. Further, if this reflex mechanism remains active during anesthesia, as suggested by Dr. Stuth et al., one would expect to see a greater incidence of bronchospasm (regardless of the general anesthetic technique used) in the patient population. It is possible that there is more than one mechanism involved in triggering severe bronchospasm seen after rapacuronium but the evidence currently available is insufficient to make any definite statement on how rapacuronium induces bronchospasm.

The patient described in my report1 received 1 mg midazolam, 150 µg fentanyl, and 200 mg propofol for induction of anesthesia. The propofol used was supplied by AstraZeneca Pharmaceuticals (Wilmington, DE). This formulation is known to produce bronchodilation.3,5 Further, there is no evidence to support Dr. Matsumura’s suggestion that the release of propofol with metabisulfite contributed to the higher incidence of bronchospasm seen with rapacuronium. In fact, this higher incidence was noted before the introduction of propofol with metabisulfite into clinical practice.6 Similarly, the statement of Dr. Matsumura that “…some patients may have been less deeply anesthetized before instrumentation of the airway” is not substantiated. In such practice, one would see a higher incidence of bronchospasm in the patient population.

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Anesthesiology, V 96, No 6, Jun 2002
In Reply:—I appreciate Dr. Matsumura’s interest. The propofol formulation in my case did not contain metabsulfite.

Regarding the patient’s depth of anesthesia, I would like to point out that despite thorough preoxygenation, she desaturated before any airway instrumentation, suggesting that bronchospasm was evolving before intubation. She had received 1 mg midazolam and 50 μg fentanyl and approximately 2.5 mg/kg propofol for induction. I doubt that light anesthesia caused her event.

The philosopher David Hume believed that an effect could never be absolutely attributed to a given cause despite their temporal association. Although there were certainly other possible causes for the problems reported by myself and others, their association with rapacuronium, a newly released drug known to produce mild bronchospasm, made it necessary to report these events to the anesthesia community.

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(Accepted for publication November 30, 2001.)

Epidural Blood Patch in Obstetric Anesthetic Practice

To the Editor:—We read with interest the article by Safa-Tisseront et al.1 reporting their experience on epidural blood patch (EBP), and would like to comment with regard to obstetric anesthesia practice. These authors reported that large diameter needles (less than 20 gauge) and a short time interval between dural puncture and blood patching (fewer than 4 days) independently predicted failure of EBP. Therefore, considering needle diameter, one must note that only 68 patients (13%) were really at risk of failure, as they underwent dural punctures with Tuohy needles (17–18 gauge). This fact likely contributed to the high success rate of a single EBP reported in the study. It can also explain why only 3.7% of the patients required a second EBP. As spontaneous relief is the natural outcome of postdural puncture headache (PDPH) when small diameter needles are involved,2 we can consider that the CSF leak may decrease over time, therefore supporting a lapse of time before performing EBP. This is also probably a strong factor of efficacy if EBP is performed at least 4 days after the dural puncture, assuming that 87% of patients in the study had undergone diagnostic or therapeutic lumbar punctures with small gauge needles.

However, despite the threshold lapse of 4 days, as shown in the study, Safa-Tisseront et al.1 did not recommend to delay EBP. This message is very important for obstetric anesthesiologists, although a higher failure rate must be expected after a single EBP. In our experience of 21 consecutive cases of PDPH complicating epidural procedures with 17 gauge needles, all but one patient had an EBP within 4 days, including 15 women who had their EBP within the first 2 days. Ten patients required a second EBP for headache relief on the day after the first EBP, because although they had experienced complete relief, the effect was transient. Several points are in favor of early EBP. Indeed, given that PDPH are usually severe and incapacitating in obstetric patients and prevent women from taking care of their newborns, given that the delay of an effective treatment makes the patient depressive and/or their family aggressive, and finally, given the low morbidity of EBP, confirmed by the authors, we believe that, at least in the obstetric setting, EBP should be performed as soon as possible and should not be delayed. We therefore strongly support Quaynor and Corbey’s assertion:3 “Epidural blood patch: why delay?” Furthermore, obstetric patients undergoing EBP and their families should be informed of the fact that PDPH relief is sometimes transient, and that a second EBP might be required.

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References


(Accepted for publication December 31, 2001.)

In Reply:—We appreciate the interest and the comments of Dr. Aya et al. regarding our article.1 Our study included all patients treated with an epidural blood patch (EBP) for incapacitating postdural puncture headache (PDPH) in our hospital, from all medical and surgical specialties, including obstetrical patients. The incidence of accidental dural puncture during epidural anesthesia (performed with Tuohy needles, 17 gauge) was 57%, which is compatible with the rate reported by Safa-Tisseront et al. The incidence of PDPH was 57% during epidural anesthesia, which is also comparable to the rate reported by Safa-Tisseront et al. The authors reported a success rate of 95% with single EBP. In our study, a single EBP was performed in 85% of our patients, and the success rate was 80% in the first EBP and 18% in the second EBP. The rate of failure in the second EBP was not as high as in the study of Safa-Tisseront et al.

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(Accepted for publication November 30, 2001.)

In Reply:—We read with interest the article by Safa-Tisseront et al.1 reporting their experience on epidural blood patch (EBP), and would like to comment with regard to obstetric anesthesia practice. These authors reported that large diameter needles (less than 20 gauge) and a short time interval between dural puncture and blood patching (fewer than 4 days) independently predicted failure of EBP. Therefore, considering needle diameter, one must note that only 68 patients (13%) were really at risk of failure, as they underwent dural punctures with Tuohy needles (17–18 gauge). This fact likely contributed to the high success rate of a single EBP reported in the study. It can also explain why only 3.7% of the patients required a second EBP. As spontaneous relief is the natural outcome of postdural puncture headache (PDPH) when small diameter needles are involved,2 we can consider that the CSF leak may decrease over time, therefore supporting a lapse of time before performing EBP. This is also probably a strong factor of efficacy if EBP is performed at least 4 days after the dural puncture, assuming that 87% of patients in the study had undergone diagnostic or therapeutic lumbar punctures with small gauge needles.

However, despite the threshold lapse of 4 days, as shown in the study, Safa-Tisseront et al.1 did not recommend to delay EBP. This message is very important for obstetric anesthesiologists, although a higher failure rate must be expected after a single EBP. In our experience of 21 consecutive cases of PDPH complicating epidural procedures with 17 gauge needles, all but one patient had an EBP within 4 days, including 15 women who had their EBP within the first 2 days. Ten patients required a second EBP for headache relief on the day after the first EBP, because although they had experienced complete relief, the effect was transient. Several points are in favor of early EBP. Indeed, given that PDPH are usually severe and incapacitating in obstetric patients and prevent women from taking care of their newborns, given that the delay of an effective treatment makes the patient depressive and/or their family aggressive, and finally, given the low morbidity of EBP, confirmed by the authors, we believe that, at least in the obstetric setting, EBP should be performed as soon as possible and should not be delayed. We therefore strongly support Quaynor and Corbey’s assertion:3 “Epidural blood patch: why delay?” Furthermore, obstetric patients undergoing EBP and their families should be informed of the fact that PDPH relief is sometimes transient, and that a second EBP might be required.

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necessity of performing a second EBP. This information must be tai-
lored according to the diameter of the needle that is used to perform
the dura mater puncture. This information might allow for a better
acceptance of EBP failure by patients, and therefore, a better accep-
tance of a second EBP. In our opinion, these elements and the safety of
the EBP favor early EBP realization in patients with severe PDPH after
dural puncture with a large bore needle, including obstetrical patients.

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ANESTHESIOLOGY 2001; 95:575–7

(Accepted for publication February 18, 2002.)

Anesthesiology 2002; 96:1532–2

Multifactorial Etiology of Postoperative Vision Loss

To the Editor.—The thoughtful discussion of the case report “Unilateral
Blindness after Prone Surgery” by Drs. Lee and Lam1 reasonably excluded
systemic hypotension and anemia as independent etiologic factors. How-
ever, the discussion was deficient in three respects. First, although they
claim that the eyes within the soft foam cushion (manufacturer and model
unreported) were intermittently “checked” every 30 min, conventional
eye checks in the prone position can only be performed by peeling or
pressing the foam cushion away from the eyes to visualize them. How-
ever, peeling or pressing the foam cushion away from the eyes necessi-
tively changes the relationship of the foam cushion to the eyes; i.e., the test itself
changes the results. The eyes can also be checked by palpation, but this is a
blind procedure, which also requires the fingers to peep or press away
the foam cushion from the eyes. Furthermore, since the patient’s face at
the end of procedure was “extremely edematous,” the physical relation-
ship of the eyes to the foam cushion must have been continuously
changing in the direction of increasing intraocular pressure. The point in
stating these limitations of the traditional eye check is that the new
Prone-View foam cushion system (Dupaco) allows the eyes to be continu-
ously and directly visually monitored (by mirror image) without the need
to manipulate the foam cushion.2

Second, the authors failed to comment on the height of the nasal
bridge of the patient. A low nasal bridge allows the medial aspect of the
eyes to experience greater contact and pressure with the foam cush-
ion, and as the periorbital area becomes relatively more edematous
than the nasal bridge, the medial aspect of the eyes will press harder
into the foam cushion.

Anesthesiology, V 96, No 6, Jun 2002
Anesthesiology 2002; 96:1532–3

In Reply—We appreciate the interest of Drs. Benufo and Mazzei in our case report of visual loss after an uneventful spine surgery in the prone position in an otherwise healthy patient. They expressed concerns about several issues. In particular, their emphasis on “adequacy” of eye-check and padding provides us with the opportunity to address an important issue that we perhaps did not adequately explain in our report, leading to their misunderstanding. Adequate padding of the head in the prone position to prevent pressure on the eyes is important, and in the case we reported, we used a standard foam support (GentleTouch Headrest Pillow, Orthopedic Systems Inc., Union City, CA) with a cut-out for the eyes. Eye-checks can be performed accurately by pressing down on the side of the foam cushion without altering the correct positioning. The patient is of Caucasian extraction with a high nasal bridge. Moreover, the nasal bridge is of no consequence provided that the eyes are positioned correctly in the cut-out portion of the foam cushion.

Of utmost concern is their perseveration regarding the type of foam cushion, the height of the nasal bridge, and the method of eye-checks, which underscores a fundamental lack of understanding. And a common misconception about the pathophysiology of visual loss after spine surgery. The lesion lies posterior to the lamina cribosa, sparing the retina, and has never been shown to be related to pressure on the globe. Visual loss from pressure on the globe, on the one hand, is secondary to central retinal artery occlusion with or without anterior ischemic optic neuropathy. These patients will frequently show signs of external periorbital bruising or proptosis, with
To the Editor—As new technology enters the operating room, integrated computers “automatically” manage functions and parameters normally controlled by the anesthesiologist. While our background and training in pharmacology allows us to fully understand the implications of using a new drug, our relative lack of training in mechanical and electrical engineering forces us to “assume” new technology brought to the operating room is safe. In this letter I would like to report an episode of incompatibility between the automated systems of a Datex-Ohmeda D-Tec® “Plus” Desflurane vaporizer (Datex-Ohmeda, Inc., Madison, WI) and a Draeger Medical Julian anesthesia machine (Draeger Medical, Inc., Telford, PA) that resulted in the intraoperative failure of the vaporizer.

The episode occurred after the uneventful induction and intubation of an otherwise healthy 36-yr-old woman presenting for a laparoscopic tubal ligation. The Julian ventilator was programmed for volume control ventilation with a tidal volume of 600 ml, a respiratory rate of 8 breaths/min and an I:E ratio of 1:2.5 with a 50% oxygen in air mixture at 2 l total flow. The Desflurane vaporizer was initially set at 8% and then reduced on reaching an expired concentration of 6%. Approximately 20 min into the case (10 min of mechanical ventilation), the Desflurane vaporizer alarm labeled “no output” went off, and the Desflurane concentration in the anesthesia circuit began to fall. The Desflurane vaporizer was immediately turned off and isoﬂurane was added to the inspired gas flow to ensure adequate anesthetic depth. After several seconds the Desflurane vaporizer automatically reset, and a second attempt was made to use the vaporizer. Within several minutes the same no output error occurred. To rule out the possibility that the failure was caused by obstruction at the vaporizer attachment site, the vaporizer was removed and repositioned in another site. Once again the vaporizer would work for approximately 5 min before alarming no output. To determine if this was a faulty vaporizer, the vaporizer was exchanged for a new one, however, the problem persisted. It was hypothesized that the no output condition might be secondary to the current ventilator settings. Despite changes to the tidal volume, flow rate, % inspiratory pause, and I:E ratio the Desflurane vaporizer continued to fail within minutes of being started. By this time the surgery was coming to a close, so the use of Desflurane was abandoned and the surgery was completed using isoﬂurane. The patient had an uneventful wake-up with no recollection of intraoperative events.

In an effort to determine if the vaporizer failure was caused by the mode of ventilation, the next patient in the room was ventilated using pressure control ventilation with settings that would result in ventilatory parameters similar to those used in the previous case. The patient was once again started on Desflurane, however, this time the vaporizer worked without any problem. To validate our finding an attempt was made mid case to switch to volume control ventilation. The no output alarm was triggered within 50 s of switching ventilation modes. After reinitiating pressure control ventilation and allowing the Desflurane vaporizer to reset, the remainder of the surgery proceeded without incident.

To better understand what had occurred, technical representatives from both Draeger and Datex-Ohmeda were contacted. The companies supplied the following information that helps to clarify the cause of the failure of the vaporizer in volume control ventilation mode. The new Draeger Julian ventilator is capable of operating in three different modes, spontaneous ventilation (or hand-bagging with pop-off valve), volume control ventilation, and pressure control ventilation. The ventilator controls are entered via a digital interface. When in volume control mode, the interface allows the anesthesiologist to set the tidal volume he wishes the patient to receive and automatically compensates for changes in fresh gas flow. The ventilator compensates for fresh gas flow by decoupling the fresh gas flow from the ventilator circuit during the inspiratory phase of ventilation. As a result, during the inspiratory phase of the ventilatory cycle, there is no fresh gas flow into the patient circuit. A Draeger representative explained that the way decoupling works is that all the fresh gas is delivered during expiration. The fresh gas flow set by the anesthesiologist is actually the average flow over the course of the respiratory cycle. The actual gas flow is zero during inspiration, and higher than the set flow during expiration, so the average is what that user has set. For example, at an I:E ratio of 1:2 and a set gas flow of 4 l/min, actual gas flow is 6 l/min during expiration and zero during inspiration, thus averaging 4 l/min. This results in a period of time where there is no flow past the vaporizer.

The Desflurane vaporizer made by Datex-Ohmeda has an imbedded circuit board that senses output from the vaporizer and turns off the vaporizer if no output is detected. According to the technical personnel at Datex-Ohmeda, the vaporizer monitors the power source, temperature, tilt, fluid level, and pressure differentials between the input and output ports. If any of these parameters deviate from “normal” the vaporizer shuts down. The engineers I spoke with reported that the changes made between the original Tec 6 Desflurane vaporizer, used during the certification of the Julian ventilator, and the Tec-D Desflurane...
The D-Tec Plus vaporizer was made to help increase the functional life expectancy of the vaporizer and minimize maintenance requirements. However, the changes were felt to have minimal impact on the overall function of the vaporizer and therefore did not require FDA recertification. There was agreement among representatives from both companies that the circumstances pointed to the vaporizer sensing the decoupling of flow in volume control mode. When pressure control or spontaneous ventilation modes are used on the Julian ventilator, fresh gas flow is continuous, as there is no need to compensate for fresh gas flow during inspiration. In these modes, the vaporizer senses continuous flow and no error is triggered. This would explain the uneventful nature of the second case where pressure control ventilation was used.

This case serves to emphasize the importance of fully understanding the equipment we use every day. Even seemingly minor upgrades in a previously approved piece of equipment can result in unforeseen problems. If a drug company were to present a new drug, we would expect the manufacturer to present the results of rigorous testing and thorough risk analysis in the process of designing equipment. Despite these high standards, equipment malfunctions will occur in the process of delivering anesthesia. Patient injury can be avoided, as it was in this case, by using equipment with appropriate alarm technology, recognizing a problem when it occurs, having a backup plan, and taking corrective action in timely fashion.

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**Reference**


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the D-Tec Plus software has been upgraded. This upgrade has been provided to all the D-Tec Plus vaporizers in use and is currently being used during the manufacture of all new D-Tec Plus vaporizers.

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**Reference**


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**An Unusual Presentation of an Airway Foreign Body Involving Dentures**

*To the Editor:*—A 78-yr-old woman was admitted to the hospital for repair of a fractured wrist, sustained in a fall. A rapid sequence induction was performed and her dentures were left in place until laryngoscopy. An uneventful general anesthetic was administered, and the patient was successfully extubated and taken to the recovery room in satisfactory condition. Several minutes after admission to the recovery room, her SpO₂ decreased from 99% to approximately 78%. She subsequently had a severe episode of coughing and expectorated a foreign body later identified as a Seabond® (Combe Inc., White Plains, NY) denture adhesive sheet.

Dental appliances, discovered by patient interview or examination, are left in place before intubation to aid in the performance of mask ventilation, should this prove necessary. Local pharmacies carry 15 varieties of dental adhesives, three of which use paraffin impregnated flannel sheets (two brands are shown in fig. 1). The Seabond® adhesive system consists of two separate sheets impregnated with a water-based adhesive which, when moistened, is applied to the denture and forms an efficient suction bond with the roof of the mouth. The patient expectorated one of these sheets; it is not known where the other went.

It is theorized that the sheet of adhesive, affixed to the roof of the mouth and to the denture, stayed in the mouth. It then adhered to the endotracheal tube as it passed through the oral pharynx, and was deposited in the airway. The obstruction became manifest in recovery and was dislodged by the patient’s coughing, without further sequelae.

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**Fig. 1.** Seabond® denture adhesive (*left*); EZO® paraffin impregnated flannel sheet (*right*).