Nutritional support in patients with low volume chylous fistula following radical neck dissection

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Abstract

One of the well known complications of radical neck dissection is a chylous fistula, which results from injury to the thoracic duct as it enters the left subclavian vein. Such fistulae may cause considerable increased morbidity to a patient who is already debilitated by malignancy and by the increased catabolic response to surgery. Further surgery may be appropriate for those with a high fistula output but conservative therapy is normally advocated for the remainder. Nutritional and electrolyte support for these patients is essential and poses potential problems in management.

We present three such patients. One was fed parenterally and two enterally and in all cases the fistulae closed spontaneously. We examine the known physiological stimuli to chyle production and conclude that the enteral feedings of these patients with fat or an isomolar enteral feed does not, contrary to current belief, increase chyle flow or delay the healing of these fistulae.

Introduction

The thoracic duct returns lymph to the blood stream and forms the final common pathway for all lymphatic flow except that which drains from the right side of the head and neck and hemi-thorax, right lung, upper surface of the liver, right limb and right side of the heart. The duct varies in length from 15–18 inches and has a variable course within the neck. In particular, while it is commonly supposed to terminate at the junction of the internal jugular and subclavian veins (Walls, 1981), the final entry point into the venous system is extremely variable and it may instead enter directly into either the subclavian, the internal jugular or the innominate veins. More importantly this terminal part is often not formed into a single trunk, but is instead constituted of a number of small tracts with variable entry points into the venous system (Kinnaert, 1973). It may thus be easily damaged during routine surgery in this area.

Chyle, which is the term normally applied to the fluid which returns to the venous system through the terminal portions of duct, is almost identical to tissue lymph in both its chemical and physical properties. However, it differs in having a higher concentration of finely divided fat particles, soaps, lecithins and cholesterol. Inadvertent damage to the duct may result in a fistula with leakage of this fluid on the skin of the neck and anterior chest wall, and this is liable to result in difficulties both with maintenance of nutritional status and with local skin care.

From reviewing the literature, it is clear that there is no concensus as to how such fistulous leaks should be managed and, in particular, little agreement as to the means that should be used to maintain nutritional status. This report presents our experience in dealing with three established low volume chylous fistulae all of which followed surgery for advanced head and neck malignancy and all of which were managed conservatively and without further operative intervention. The aim of the study was to establish whether the means used to feed these patients post-operatively was of importance in promoting the successful closure of their fistulae.

Materials and methods

Three patients who had undergone neck dissection for metastatic squamous cell carcinoma were studied. In each instance the primary site and neck had been irradiated prior to surgery and operation had been undertaken because of a clinically proven recurrence. Each patient developed a thoracic duct leak through the wound and the management of each case was similar with the exception that the means used to maintain post-operative nutritional status was deliberately varied. Points of similarity included skin protection using a proprietary skin protective (Stomadhesive, Squibb and Sons Ltd.), monitoring of the volume of chyle and protection of the skin by collection in a stoma bag applied to the fistula (Bacterobag), intravenous antibiotics (if wound swabs showed this to be necessary), the continuance of normal wound drainage until cessation of lymphatic flow and careful monitoring of the patient with regular chest X-rays and estimations of full blood count, urea and electrolytes, liver function and serum proteins

including the serum albumin. However, the feeding of the patients was dissimilar. The first was fed using parenteral nutrition and the second and third by naso-gastric tube through which was given Calogen and Osmolite (Abbott Laboratories Ltd.). The details of these products is given at the foot of Table II.

In all three of the patients reported, the serial chest X-rays were normal throughout treatment. The hae-moglobin, urea and electrolytes and liver function were also normal. The body mass indices (BMI) calculated as weight (kg) divided by height^2 (metres) and based on hospital weight at time of treatment is given in Table I. Also included in this Table are the expected weights of these patients and their serum albumins levels at the start of treatment. In each instance neither the BMI nor the serum albumin changed significantly during the period of treatment.

Patient 1

A 56-year-old man first presented with an extensive squamous cell carcinoma of the posterior third of the tongue which extended, on the left side, into the ipsilat-eral vallecula. At presentation, there were palpable lymph nodes in the left jugulo-digastric and mid-cervical regions; the right side of the neck was clinically disease free. A preliminary biopsy of the tongue confirmed the diagnosis of a squamous cell carcinoma (moderate dif-ferentiation), and he was initially managed with radical radiotherapy (Co^{60}).

At the first course the tongue, face and neck were irradiated with opposed fields to a total dose of 4000 cGy and this was then immediately followed by a short course to 2500 cGy to the two neck fields alone. The primary tumour responded well to this therapy and when the biopsy was repeated no tumour recurrence was identi-fied. However, the metastatic spread in the left neck did not fully respond and as a result, three months after the cessation of radiotherapy, a routine radical neck dissec-tion was performed. The subsequent sections showed necrotic poorly differentiated tumour in one third of identified lymph nodes in the specimen with clear resec-tion margins.

Five days after the surgery the patient developed a leak through the inferior margin of the wound. The fluid from this tract was analyzed and found to contain a thin layer of chylomicrons lying over a very turbid infranate containing high concentrations of triglycerides and chol-esterol: the chylous nature of the leak was thus proven.

This was managed by a strict 'nil by mouth' regimen. No antibiotics were required. A central line was inserted into the right subclavian vein and parenteral feeding started. The patient was given 1 litre Vamin 14 500 ml glucose (50%) and 500 ml Intralipid (20%) together with trace elements, vitamins and electrolytes (Additrace, Addiphos, Vitilipid N Adult and Solivito N) in a three-

in-one mixture. The total calorie intake was 2,350 Kcal/24 hours in a 2,500 ml total volume. There was no drainage through the wound drains but the fistula con-tinued to drain between 25 and 80 ml of chyle for two weeks before gradually subsiding. Drainage finally ceased altogether (and without recurrence) 20 days from outset.

Patient 2

The second patient was a 59-year-old male who pre-sented with an eighteen month history of a mass in the floor of the mouth which was partially fixing the tongue. At presentation bilateral submandibular and jugulo-digastric nodes were palpable and a CT scan confirmed involvement of the mandicular rim. Biopsy confirmed a squamous cell carcinoma (poorly differentiated) and he was managed with radiotherapy (Co^{60}) to a total dose of 4800 cGy. However there was no response to this ther-apy and a repeat biopsy at the end of treatment con-firmed the presence of a necrotic tissue mass containing viable tumour. In addition, all the patients' attempts to phonate and swallow were compromised by fixation of the tongue; this had appeared to progress during treatment.

He therefore underwent a left radical neck dissection, a right functional neck dissection and a wide excision of the floor of the mouth with rim mandibulectomy and reconstruction of the floor of the mouth with a pectoralis major myocutaneous flap. By the fourth post-operative day the intra-oral oedema that ensued was subsiding and bowel sounds were present; nasogastric tube feeding was therefore instituted.

The following day (5th post-operative day) the patient had developed a leak through the inferior margin of the wound confirmed as chyle by analysis of the fluid dis-charge. At the same stage routine wound swabs were found to contain a methicillin resistant *Staphylococcus aureus* (MRSA) and barrier nursing and intravenous antibiotics (Vancomycin 750 mg b.d.) were started. The patient's nutrition was maintained by naso-gastric tube feeding. The quantities and types of liquids given and the ensuing collections through the stoma bags and drains are shown in Table II. As can be seen, by the eleventh post-operative day the fistula drainage had ceased and the stoma bag and the wound drains were therefore removed after a further 24 hours with no sub-sequent recurrence of the fistulous leak.

Patient 3

A 60-year-old man presented with a large right-sided pyriform fossa tumour which was involving ipsilateral laryngeal structures but which had not clinically spread into the neck. Biopsy confirmed this lesion to be a squamous cell carcinoma and he was managed with

TABLE I

Patient Number	Height (metres)	Normal Weight (kg)	Hospital Weight (kg)	Wt/Height^2 (Body mass) index*	Albumin* (g/l)
Patient 1	1.62	57.0	46.3	17.6	33.0
Patient 2	1.67	68.0	46.0	16.5	24.0
Patient 3	1.75	74.0	56.0	19.2	29.0

TABLE II

	Treatment day	Nutrition	Drainage (mls) Fistula	Drainage (mls) Drain
Patient 2	Day 1	5% Dextrose (iv)	35	90
	Day 2	2000 ml water (ng tube)	45	nil
	Day 3	140 ml Calogen to 2000 with water (ng tube)	50	nil
	Day 4	2000 ml Osmolite (ng tube)	204	nil
	Day 5	2000 ml Osmolite (ng tube)	100	nil
	Day 6	2000 ml Osmolite (ng tube)	30	nil
	Day 7	2000 ml Osmolite (ng tube)	70	nil
	Day 8	2000 ml Osmolite (ng tube)	20	nil
	Day 9	2000 ml Osmolite (ng tube)	5	nil
	Day 10	2000 ml Osmolite (ng tube)	5	nil
	Day 11	2000 ml Osmolite (ng tube)	nil	nil
	Day 12	2000 ml Osmolite (ng tube)	nil	nil
	Bag and drains removed			
Patient 3	Day 1	5% Dextrose (iv)	30	25
	Day 2	160 ml Calogen to 2000 ml with water (ng tube)	50	30
	Day 3	2000 ml water (ng tube)	75	30
	Day 4	2000 ml Osmolite (ng tube)	75	30
	Day 5	2000 ml Osmolite (ng tube)	70	20
	Day 6	2000 ml Osmolite (ng tube)	50	10
	Day 7	2000 ml Osmolite (ng tube)	35	10
	Day 8	2000 ml Osmolite (ng tube)	20	nil
	Day 9	2000 ml Osmolite (ng tube)	5	nil
	Day 10	2000 ml Osmolite (ng tube)	nil	nil
	Bag and drains removed			

Calogen: 50% arachis oil in water emulsion.
Osmolite: 100 mls contains: 3.4 G Fat, 4.2 G Protein and 13.4 G Carbohydrate together with 3.8 mmol Sodium, 3.8 mmol Potassium, 3.8 mmol Chloride, 1.8 mmol Calcium, 2.3 mmol Phosphate and 28.0 mg Magnesium.

primary external beam radiotherapy (Co^{60}) to a total dose of 5500 cGy. For almost exactly two years he remained clinically free of tumour but then presented with recurrence at the primary site which had spread into the neck and was involving the thyroid gland. This was managed successfully with a total laryngectomy, total thyroidectomy and partial pharyngectomy.

Twenty three months later, he developed a large (7.5 × 7.5 cm) painful supraclavicular mass on the left side of the neck. An attempt to remove this mass in toto was unsuccessful, but a "debulking" of the metastasis was achieved and this alleviated much of the pain which he had been experiencing.

In view of the limited nature of the procedure, and there being no other contraindications, the patient was offered fluid by mouth on the first post-operative day.

However it became apparent very shortly afterwards that he had a leak from the wound site and his oral intake was therefore stopped immediately. Routine biochemistry again confirmed the chylous nature of the discharge, and the measures outlined in the management of the second patient were instituted except that no antibiotic support was required.

However, in this patient the initial sequence offered in the feeding regimen was altered. Again the sequence and types of fluids given together with the volume of the fluid discharge are shown in the accompanying table (Table II). By the ninth post-operative day, the fistulous leak had diminished to negligible proportions and both the bag and drains were removed on the tenth day. The fistula dried completely after this time without further intervention and did not recur during the follow-up period.

Discussion

Chylous fistulae as a complication of head and neck surgery have been recognizsed since the 19th century (Stuart, 1907) and are thought to follow between 1 and 2% of all radical neck dissections (Strong, 1969; Crumley and Smith, 1976; Wright and Kenyon, 1987; Spiro, et al., 1990). However the immediate management of such problems has received only limited attention, and the range of remedies that have been proposed for the treatment of the established case remain unevaluated. Thus while most authors would agree that an initial trial of conservative management is appropriate, the exact means of effecting this are unclear; the majority would offer bed rest with head elevation, continuous suction drainage and, if appropriate, pressure dressings. However the role and efficacy of a whole spectrum of additional measures ranging from the giving of antibiotics to tetracycline sclerotherapy (Metson, et al., 1986) are untested.

The principal problem appears to be that the physiology of flow in the thoracic duct is of obvious relevance but is ill understood. Local tissue lymph formation is increased by up to 50% following increased capillary pressure, decreased plasma colloid osmotic pressure, increased interstitial protein and increased capillary permeability. Increased flow also occurs with exercise (Guyton, 1987). It is also known that under resting conditions intestinal lymph represents over half the total flow in the thoracic duct (Read, 1984), but the extent to which ingested water and nutrients influence this flow is disputed. Peak increases in lymph flow which are threefold above baseline values in response to intragastric boluses of 0.9% saline, corn oil and other fatty meals have been demonstrated in animal models, and the same experiments demonstrated a lack of effect in response to fat-free skim milk powder (Borgstrom and Laurel, 1953; Simmonds, 1955)—a finding which is of interest in a clinical context. Other experiments using marker isomers (D_2O and ^{24}Na) administered enterally, portally or intravenously have concluded that little water or sodium ion is transported through lymphatic pathways with at least 99% being carried via the portal circulation (Benson, et al., 1956).

Flow may also be stimulus dependent. Thus in other work the extra volume of lymph following ingestion of 5

ml of water was immediate and short lived whereas the response to the ingestion of an equal volume of 0.9% saline was comparatively delayed and prolonged (Simmonds, 1955; Barrowman and Roberts, 1967). This together with the observation of very early reductions in lymph protein concentration with increased flow have led to arguments suggesting that the intestinal lymphatics act as a water overflow system with the lymphatic flow secondarily dependent upon the amount and rate of presentation of water as well as the osmolality of the fluids. It therefore seems likely that the flow of lymph is primarily stimulated in response to intestinal blood flow and the ability of the luminal challenge of a bolus feed of water or food to effect this. However, little is known about the effect of continuous enteral and parenteral feeding, and even less about the comparative effect of these measures upon intestinal lymph or blood flow.

Of course these considerations have considerable relevance in the management of many patients with thoracic dust fistulae. While a purely medical approach to a fistula which has a 24 hour output in excess of 600 ml has now been shown to be academic (Spiro *et al.*, 1990), the majority do not fall into this category. Thus a conservation policy is still warranted for most patients, and arguments in favour of either total parenteral nutrition or enteral feeding using medium chain triglycerides as the sole fat source during the healing of the fistula have been advanced as being empirically justified for these cases, since both these measures are supposed to reduce the rate of formation of lymph. As has been demonstated earlier, the case for the use of either of these means of feeding is not proven on the available experimental evidence and, while various papers have reported the successful use of these means of nutritional support in patients with chylous fistulae (Bozetti *et al.*, 1982; Younus and Chang, 1988; Hashim, *et al.*, 1964), it is unclear whether these regimens were strictly necessary. Furthermore, while some series have reported low levels of metabolic or catheter-related morbidity with parenteral feeding (Chang, *et al.*, 1986; Younus and Chang, 1988), the use of such an expensive and potentially dangerous route for nutritional support seems wholly unjustified given our current knowledge.

In this paper all three patients had fistulae which produced relatively small volumes of chyle. The first received all this metabolic and nutritional requirements intravenously and the fistula dried without any further problems on the twentieth post-operative day. In contrast the second and third patients only received fluids intravenously for the first 24 hours after the fistula was apparent and, after bowel sounds were confirmed, each were given all their electrolyte and nutritional support via a nasogastric tube. When compared to the intravenous route neither the giving of clear fluids via the nasogastric tube nor the supplementing of these fluids by the addition of 50% arachis oil in a water emulsion (Calogen) had any noticeable effect upon either fistula output or wound drainage (Table II). This was further proved in the third patient by deliberately reverting to clear fluids on the third day after starting treatment; no change of any significance in either fistula or wound drainage was produced by these manoeuvres. Similarly while the use of an enteral feed (Osmolite) appeared to result in a transient rise in fistula output in the second case, this was not repeated in the third patient suggesting that such support could, in theory, have been introduced even earlier.

It is obviously difficult from such limited data to draw any hard conclusions which could be widely applied in future cases, but it does seem clear that a conservative approach to the management of fistulae producing small volumes of chyle is correct and that, in contrast to some previous reports, the use of parenteral feeding with its potential drawbacks and attendant costs is unjustified in these cases. In addition, the administration of medium chain triglycerides, which have been much vaunted as the best means of controlling chyle production, may have theoretical advantages but may not be as necessary as was previously thought in the practical management of these patients. Clearly what is necessary is that more research is now undertaken in order that we can better understand the stimuli regulating thoracic duct flow. In this way we can ensure that regimens are developed which guarantee a rational approach to the nutritional support of patients unlucky enough to suffer this complication of head and neck surgery while, at the same time, ensuring that morbidity and cost are both kept to a minimum. In the absence of such knowledge we conclude that a steady enteral infusion over 24 hours of water with or without fat or the giving of an isomolar enteral feed does not, contrary to current clinical beliefs, appear to increase lymph flow in the thoracic duct.

Acknowledgements

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