Case reports

Iodine Induced Thyrotoxicosis Following Povidine-Iodine Dressings: A Case Report

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ABSTRACT

A 40-year-old woman was admitted to the intensive care unit after a radical resection of a recurrent abdominal malignancy. Her postoperative course was complicated by sepsis requiring numerous abdominal operations with the abdomen being left open for drainage and dressings. Use of povidone-iodine soaked abdominal packs to reduce secondary infection led to development of thyrotoxicosis, which resolved following the cessation of the iodine dressings. A high index of suspicion is needed for the diagnosis of this condition in intensive care patients as the usual haemodynamic signs of thyrotoxicosis may be misinterpreted as being caused by sepsis. (**Critical Care and Resuscitation 2003; 5: 186-188**)

Key words: Iodine, povidone-iodine, thyrotoxicosis, wound packing

Iodine induced thyrotoxicosis is known to occur in iodine-deficient patients treated with dietary iodine supplementation.[1] It has also been reported with the use of iodine containing medications,[2] and iodine-based non-ionic radio contrast media.[3] During the management of severe and prolonged intra-abdominal sepsis or pancreatitis, the abdomen is often left open to prevent development of an abdominal compartment syndrome, facilitate visualisation and for continuous drainage. To prevent secondary infection the abdominal contents are often covered with packs soaked with sterile antiseptic solution. We report a case where povidone-iodine soaked abdominal packs were used to manage an open abdominal wound and led to the development of thyrotoxicosis.

CASE REPORT

A 40 year-old female patient was admitted to the intensive care unit following extensive small bowel resection, right hemicolectomy, right nephrectomy and insertion of brachytherapy catheters for recurrence of a retroperitoneal leiomyosarcoma. She had undergone a laparotomy twice before for the same lesion and had also received chemotherapy previously. She had no past history of thyroid disease. Her postoperative course was complicated by development of a persistent tachycardia and pyrexia with a laparotomy being performed on the 3rd day in intensive care to rule out intra-abdominal sepsis, which was negative. Her thyroid function tests at this time were within normal limits (e.g. TSH 0.47 mIU/L; normal range 0.3 - 3.5 mU/L, Free T_4 13.3 pmol/L; normal range 10.4 - 18.5 pmol/L, and Total T_3 1.7 nmol/L ; normal range 1.1 - 2.3 nmol/L).

The pyrexia and sinus tachycardia persisted with her temperature varying between 38 - 39.3°C and pulse rate varying between 118 – 148 beats per minute. Blood, urine and sputum cultures remained negative, although Candida albicans was cultured from the abdominal wound. Intravenous Metronidazole 500 mg 8-hourly, meropenem 500 mg daily and were administered to manage the intra-abdominal sepsis and Fluconazole (400 mg/day) was prescribed for the Candida infection. A laparotomy was performed on the 5th day in intensive care which revealed two small bowel perforations and

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multiple adhesions. The perforations were repaired and the abdominal contents were covered with povidone-iodine soaked packs. The fascia was closed using an atrium mesh and the superficial abdominal layers were left open.

She continued to show signs of sepsis with worsening pancytopenia (haemoglobin 76 g/L white cell count 1.8 x 10^9/L platelet count 65 x 10^9/L) which improved during the following seven days. She underwent eight further laparotomies over a period of three weeks to change the abdominal packs and repair multiple small bowel perforations. At the time of the last laparotomy, the abdominal cavity was closed but the skin incision was left open. The wound was covered with povidone-iodine soaked packs which were changed daily. At this stage the patient developed an unexplained tachycardia and hypertension in spite of adequate sedation and analgesia. Blood, urine, sputum and wound swab cultures taken at this time were all negative.

While there was no clinical evidence of a goiter, her plasma thyroid function tests showed a high free T_4 level (29.l pmol/L) and a very low TSH level (< 0.2 mU/L). Her free iodine levels on the next three consecutive days were 78, 130 and 172 μmol/L, respectively (normal range 0.3 - 0.47 μmol/L). Her abdomen, by this time, had been packed with povidone-iodine soaked packs with intermittent changes for 3 weeks and her abdominal wound had povidone-iodine soaked packs changed daily for 1 week. Her renal function remained normal throughout. She was commenced on intravenous propranolol (20 mg daily) and sterile saline was used instead of povidone-iodine to soak her abdominal packs. Within three weeks her cardiovascular symptoms improved and a repeat thyroid profile revealed normal function (e.g. TSH 1.3 mIU/L, Free T_4 16.7 pmol/L and Total T_3 2.1 nmol/L).

She subsequently developed an enterocutaneous fistula and imaging revealed multiple metastases in the lungs and liver. She was established on oral diet with low output from the fistula and was discharged home for palliative care.

DISCUSSION

Iodine has long been regarded as an excellent germicide and when complexed with a suitable polymer (e.g. povidone-iodine) to render it water soluble and nonirritant. The solution has very little free iodine (e.g. free iodine content of 1.67 parts per million).

Povidone-iodine is extensively used in the perioperative period for wound irrigation and for packing of wounds to achieve antisepsis. While the iodine in the solution may not be absorbed through skin surfaces, it can be absorbed through mucosal surfaces, burn wounds and peritoneum.[4] The rate of absorption is slow and in patients with normal renal function the absorbed iodine is usually quickly excreted. However, intensive care unit patients often have compromised renal function, abnormal protein levels, inflamed or injured mucosal and skin barriers and are vulnerable to excess iodine absorption, reduced excretion (and protein binding) with the possibility of high systemic levels of free iodine when povidone-iodine solutions are used.

Iodine toxicity can cause a high anion gap metabolic acidosis (usually lactic acidosis), acute respiratory distress syndrome and congestive heart failure. Fatal cases of acute systemic iodine toxicity have been reported in burns patients and in patients where continuous irrigation of infected wounds with iodine caused large amounts of iodine to be absorbed over a relatively short period. In such situations, levels as high as 7000 mg/dL have been documented.[5] When absorption is over a prolonged period, which may occur with prolonged cutaneous iodine application, the effects are usually less serious. Nevertheless, cases have been reported where months and years of cutaneous iodine application have lead to thyrotoxicosis.[6,7]

The adverse effects of iodides can he divided into two types: extrathyroidal and intrathyroidal. Extrathyroidal reactions are mainly benign and include cutaneous iodism and various allergic reactions. Intrathyroidal reactions include thyrotoxicosis which may be life threatening. Increased iodine availability can cause iodine induced thyrotoxicosis in susceptible patients, which include patients with endemic and nonendemic goiters, hyperfunctioning thyroid nodules and Grave's disease. It can also occur in patients without previous evidence of thyroid disease. The presentation is often atypical with a predominance of cardiovascular symptoms, mainly sinus tachycardia and atrial fibrillation. Depression, proximal myopathy and neuropsychiatric problems are also common.[8]

In critically ill patients, on long term ventilatory support, with intravascular lines and who undergo frequent invasive procedures, the causes of the above signs and symptoms are multifactorial. It is difficult to diagnose thyrotoxicosis in the critically ill patient on the basis of haemodynamic or neuropsychiatric signs alone. Our patient had recurrent intra-abdominal sepsis with respiratory failure. The tachycardia and hypertension were likely to be attributed to inadequate analgesia or sedation and/or as a marker of sepsis. Repeated blood, urine, sputum and abdominal wound cultures were negative and she had been receiving adequate doses of morphine and midazolam. Hence a possibility of thyrotoxicosis was considered and thyroid function tests were performed.

Various reports have provided evidence that povidone-iodine can cause impaired wound healing and

reduced wound strength. It is also toxic to phagocytic cells and suppresses the lymphocytic immune response.[9,10] Most of the data regarding use of antiseptics for wound dressings are in burns patients where evidence suggests that a single application of a povidone-iodine solution to colonised burn surfaces reduces bacterial numbers at the surface but has little effect on bacterial numbers within the deeper layers. The effect of repeated applications of iodine on the bacterial count is at present unknown. Rodebeaver and colleagues,[11] found that wounds contaminated with 10^4 to 10^7 *Staphylococcus aureus* organisms, when they were treated with either povidone-iodine antiseptic solution or 0.9% saline solution, the infection rates were similar. Four days after treatment, both groups had the same number of viable bacteria on the wound surface. While there is no evidence that irrigation of contaminated wounds with iodine solutions gives any additional benefit compared with isotonic saline irrigation, there are minimal data on the beneficial effects of any antiseptic agent when used to soak packs that are placed within abdominal cavities. Moreover, in the infected abdominal cavity the presence of a foreign material (e.g. an abdominal pack) may promote bacterial growth.

Povidone-iodine solution, with its toxic potential, particularly in patients with renal impairment, and its therapeutic effects similar to isotonic saline, would seem to have minimal benefit when used as an antiseptic agent in the intensive care unit. We believe that if povidone-iodine solutions are used for irrigation or packing of large wounds, serial determination of free iodine levels should he carried out to detect early iodine toxicity.

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