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Attention Mr M Bradshaw

Dear Mr Bradshaw

Re: Terence Lindsay

Further to your letters of 13 and 21 June 2000 re Terence Lindsay.

To answer the specific questions of your second letter:

1. *Should the position of the naso-gastric tube have been checked prior to loading the tube with gastrograffin contrast solution*

   Yes. The methods of checking the position of a nasogastric (NG) tube are either clinical or by imaging. Clinical checking includes response of the patient at the time of passing the nasogastric tube, whether gastric aspirate contains bile or food, and whether the material aspirated tests for acid.
   It is not clear from the clinical notes how sedated the patient was at the time of passing of the NG tube. He was certainly distressed. Most conscious people will respond with violent coughing to the passage of a tube into the bronchial tree.
   A well penetrated chest x-ray is the best imaging method of checking the position of an NG tube.

2. *If the position had been checked prior to the loading of the solution, should the malpositioned tube have been noticed and corrected*

   Obviously it should have been corrected. It depends how its position had been checked.
   As indicated above, there are conceivably ways in which clinical checking can go astray, although if one aspirates large amounts of bile from the tube it is unlikely to be misinterpreted.

3. *What effect could a 2% solution of gastrograffin have on lung tissue*

Can we be certain that it was a 2% solution of gastrografin introduced? Gastrografin undiluted has a high osmolarity of approximately 2.15 m osm/Kg H_2O. It would be of interest to find out if the gastrografin was premixed in the pharmacy, mixed in radiology or mixed in the ward prior to insertion. It would appear from the clinical notes that it was mixed with water (Notes: Nursing, 21/1/00 14.30 hours) but no detail is available about the volume of gastrografin added to the 400 mls of water.
Information provided by Schering, the manufacturers, indicates that the osmolarity of a 2% mixture of gastrografin correctly mixed with water would be approximately 100 m osmols/litre. This means that the fluid is hypotonic relative to plasma. The effects of this fluid would be equivalent to fresh water immersion.

The effects of a 2% solution of gastrografin on lungs are thus:
(i) freshwater drowning effect;
(ii) the possibility of an allergic reaction to the iodine based contrast;
(iii) the possible effects of additives to the gastrografin

The additives in gastrografin are: a) disodium editate - a chemical preservative; b) saccharin - a sweetener; c) anise oil - for flavour; d) polysorbate 80 - a wetting agent. All would be significantly diluted in a 2% solution.

4. *Is 400mls a large amount of fluid to place in a lung and what is the effect on the lung of this amount of fluid*

This question ties in with No. 3 above. I will answer them both together.

(i) The CT scan and chest x-rays before and after performed on 21/1/00 should be viewed to assess the amount of pulmonary opacification produced by the 400 ml of fluid. How much stayed in the lung and how much was coughed up?

(ii) The chance of an allergic reaction to the gastrografin would seem low, would be a systemic reaction and does not appear to have occurred. It will not be considered further.

(iii) 400 mls of fluid in airways decreases the ability of the lung to transmit oxygen. Hypoxia?

(iv) 400 mls of fluid placed in the lungs of an alert patient would prompt a violent coughing reaction and a considerable amount would be cleared fairly rapidly. This patient apparently tolerated the insertion of an NG tube into his bronchi and the infusion of fluid into the bronchi with no apparent immediate adverse response. It does not appear from the notes that the presence of the gastrografin solution in the lung was noted until the CT scan.

The opinion of a respiratory physician or intensivist should be sought about the long term effects of such aspiration.

5. *What further complications could result from this type of occurrence*

The complications depend on many of the factors listed above. If there is tissue damage or if there is a considerable period of time where the fluid is in the lung without being actively aspirated or coughed up, then the potential for more permanent damage in the form of tissue injury with a secondary infection, abscess formation and scar formation could occur.

Again, a study of the series of chest x-rays and CT scans performed at Logan Hospital and the chest x-ray performed at the Mater would help assess how the gastrografin solution affected the lung.

6. *Was the post-incident reaction by medical staff appropriate*
7. *What further tests/treatment and or action could have been taken by medical staff*
8. *Did a delay in treatment lead to an exacerbation of the injury and/or condition*

It is not within my area of expertise to answer these questions and a response should be obtained from a respiratory physician or an intensive care specialist. I have no details of the final status of the patient to know whether there is exacerbation of the injury.

9. *Is Gastrograffin a radioactive contrast solution*

No.

10. *What are the consequences of this solution being in contact with lung tissue*

See 3, and 4, above.

11. *Is our client at any greater risk of future complications and/or conditions as a result of this inadvertent exposure to gastrograffin*

There is no future correlation as to the exposure to gastrografin with regards to gastrografin as a chemical substance. No evidence is available to suggest that the patient will have a heightened sensitivity to other iodine based contrast agents after this administration.
He is most probably at greater risk of secondary injury to the lung but again that should be answered by someone who has expertise in that area and a knowledge of the eventual degree of injury to the lungs.

12. *In your opinion, could this event have precipitated and/or contributed to the deterioration of the patient and his lengthy stay in ICU and his ongoing symptoms*

From the notes it appears that the patient's condition deteriorated significantly approximately twelve hours after the insertion of the gastrograffin.
The patient's deterioration appeared to be predominantly respiratory but it is difficult to read the clinical notes. However, the deterioration would appear to be due to hypoxia and thus it would be hard to dissociate this deterioration from the fluid in the lung. I have no information about his later stay in intensive care as he was transferred from Logan Hospital to the Mater Hospital and no details of his inpatient stay in the Mater are available.

13. *In the event of reactions to the gastrografin, what treatment could be provided*

This question overlaps with questions 6, 7 and 8 above and is probably better answered by an intensivist or a respiratory physician.

From the information provided it would appear that the risk of injury was caused by the volume of fluid injected with the chemical effects of gastrografin and its additives being so diluted as to be negligible.

14. *Our client has an appointment with a thoracic surgeon to assess his current level of pulmonary disability. Is it reasonable to expect a long term disability to his lung function as a result of his experience*

This question cannot be answered from the documentation given to me and would require a thoracic surgeon or a respiratory physician to answer this.

15. *Does the CT procedure involving the gastrografin have any recognised complications and/or risks*

The administration of gastrografin will be dealt with in the next question. The major problems are inadvertent administration of gastrografin, as in this case, or vomiting with secondary pulmonary aspiration.
The risks of giving undiluted gastrografin are well documented in the literature yet there are other reasons for using 2% gastrografin for CT. Undiluted gastrografin is far too dense to be of any value in CT and thus only a dilute form of gastrografin is used for CT.

16. *Was there an alternative procedure that could have been undertaken with reduced risks*

The justification for giving some form of oral contrast medium is fairly strong, as the effects of pancreatitis on the stomach, duodenum, small bowel or large bowel can be quite profound. When giving oral contrast for CT the choice is between either a dilute barium solution or a water soluble solution. The choice of gastrografin or some other form of diluted water soluble contrast agent would be virtually universal in a patient in this condition. The error lay in the placement of the nasogastric tube, not in the method of performing the CT.
I note in the clinical notes of 21/1/00 that a RMO [illegible] (?) comments that the patient vomited whilst passing the nasogastric tube and [illegible] the nasogastric tube filled with gas. Whether the filling with gas was [illegible] placement in the airways is not clear.

Recommendations:

1. Obtain and have reviewed the chest x-ray and CT [illegible] of 21/1/00 to assess the volume of lung(s) flooded with the gastrografin solution.

2. Obtain the opinion of a specialist respiratory physician or specialist intensivist about the effects of "freshwater drowning" on the lung.

3. Obtain the opinion of a specialist respiratory physi specialist intensivist about the possible additional effects of detergent, swee d flavouring agent on the lung.

This report is made solely from the information you ha ided. No images have been viewed.

If there is any further information I can give, do not ho ask.

Yours faithfully.

Jim Roche
Associate Professor Radiology