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LEADING THROUGH CHANGE

Evaluating the Usefulness of Contrast Medium Injection Protocol Changes to Prevent Large Amounts of Air Injection in Contrast-enhanced CT Scans

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1. BACKGROUND

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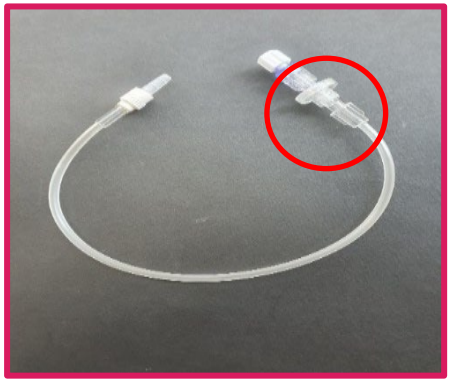
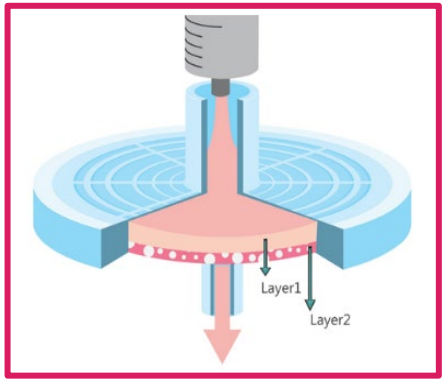


a) Extension filter line that causes psi to rise (5㎛ filter)



b) Syringe filter illustration to which the same principle is applied

https://www.ud-technology.com/syringe-filter

c) PSI graphs displayed on the injector monitor

- Some CT power injectors use the function of stopping an injection by recognizing it as air when less than a certain standard **psi** is detected
- In recent clinical environments, **tubes with filters** have been used to prevent reflux and remove impurities that then **raise the basic psi.**
- This has led to the problem of injecting a large amount of air into a patient's veins.
- Therefore, confirming the effectiveness of the anti-air injection function based on psi, and that it is necessary **to find a suitable contrast medium injection protocol for a clinical environment.**

2-1. MATERIALS & METHODS

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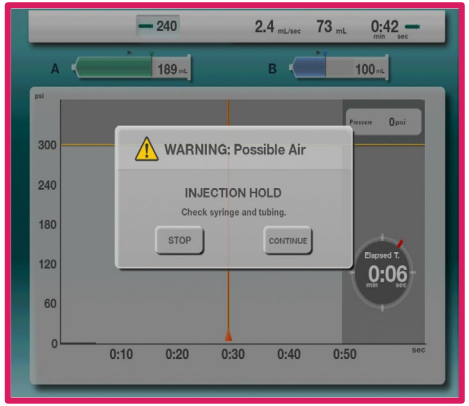
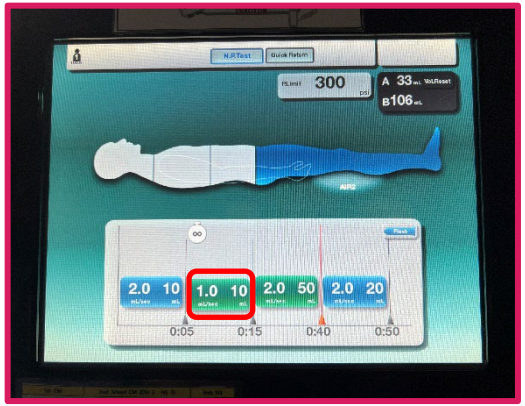
a) Nemoto Kyorindo co., Ltd. Dual Shot Alpha 7 injector



b) When the injector recognizes the air and stops it



c) Contrast medium injection protocol changed to maintain low psi

- **Nemoto Dual Shot Alpha 7 injector** was used; it recognized that air was injected when the psi remained **below 4 during the initial 10cc injection**
- In consideration of this, the protocol was altered by injecting a contrast medium for contrast enhancement after the injection of **volume 10cc** and the **flow rate was 0.5, 1.0, and 1.5cc/sec**
- Injection of a 10cc contrast medium at a low flow rate first does not affect contrast enhancement because the **contrast medium does not reach the patient's blood vessels and remains only on the injector line.**

2-2. MATERIALS & METHODS

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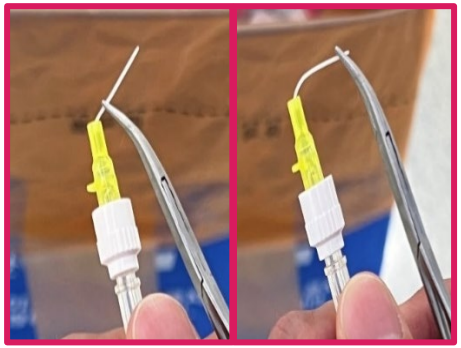
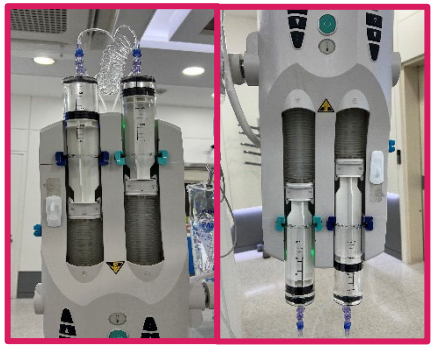
a) A ratio of the syringe internal contrast medium and air

b) When the injector recognizes the air and stops it



c) IV cannula angle was 45 and 90 degrees.



d) upper and lower directions of the injector

- Experiments were conducted by changing factors that could affect psi to reproduce the environment while injecting a contrast medium into actual patients.
- The syringe internal **contrast medium, air ratio** with the total amount being 100cc, **contrast medium concentration** was 350, 400 mgI/mL, **needle gauge**, and **IV cannula angle** was 45, 90 were finally tested by changing the **upper and lower directions of the injector** with regards to the pressure tube method.
- After measuring one time, the air inside the syringe was compressed to fully emit all of the air and air was injected again for this experiment.

3. RESULTS

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Flow Rate 0.5cc/sec	**Contrast medium : Air (Total 100cc)**								
Needle Gauge	1:9	2:8	3:7	4:6	5:5	6:4	**7:3**	**8:2**	**9:1**
18G	O	O	O	O	O	O	**X**	**X**	**X**
20G	O	O	O	O	O	O	**X**	**X**	**X**
22G	O	O	O	O	O	O	**X**	**X**	**X**
24G	O	O	O	O	O	O	**X**	**X**	**X**
Flow Rate 1.0cc/sec	**Contrast medium : Air (Total 100cc)**								
Needle Gauge	1:9	2:8	3:7	4:6	5:5	6:4	**7:3**	**8:2**	**9:1**
18G	O	O	O	O	O	O	**X**	**X**	**X**
20G	O	O	O	O	O	O	**X**	**X**	**X**
22G	O	O	O	O	O	O	**X**	**X**	**X**
24G	O	O	O	O	O	O	**X**	**X**	**X**
Flow Rate 1.5cc/sec	**Contrast medium : Air (Total 100cc)**								
Needle Gauge	1:9	2:8	3:7	4:6	5:5	6:4	7:3	8:2	9:1
18G	X	X	X	X	X	X	X	X	X
20G	X	X	X	X	X	X	X	X	X
22G	X	X	X	X	X	X	X	X	X
24G	X	X	X	X	X	X	X	X	X

- **At the flow rate of 1.0cc/sec or lower, the injector recognized air injection**, but not at 1.5cc/sec. Among other variables, **only the ratio of the syringe's internal contrast medium and the air was a factor affecting psi**, whereas other factors did not affect psi changes.
- In contrast to the air ratio, the higher the contrast medium ratio, the higher the psi, and **the injection was not stopped at 7:3, 8:2, and 9:1.**

4. DISCUSSION

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- Initially, it was important to lower the pressure inside the syringe. **At first, the psi remained low, then the air was compressed. Even when there was no ejection from the syringe, the psi rose and the injector did not recognize the air.**
- Depending on the ratio of Syringe internal contrast medium to air, the injection stop system may sometimes not work, so it is recommended that the injector be used facing down.
- In addition, injecting 10cc of contrast medium first at a low flow rate before an injection can prevent an examiner's carelessness without affecting the contrast enhancement. Therefore, in the case of an injector that does not have an air detector and recognizes air injection based on psi, **injecting first at a low flow rate before injecting a contrast medium can be useful to prevent a large amount of air injection.**

5. SUMMARY & ONGOING WORK

- Factors influencing psi rise include **injection flow rate** and **ratio of the syringe's internal contrast medium and air**
- When **the ratio of the air inside the syringe is high**, it is possible for the injector to recognize it as air and stop **when injected at a low flow rate.**
- Further study – **Appropriate psi settings for recognizing air** in clinical environments using filter tubes

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THANK YOU