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Avoiding unconscious injection of vial-derived rubber particles during intra-articular drug administration

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Background

Vial coring describes the occurrence of small rubber particles, which are formed by needles when perforating vial stoppers. These particles may be aspirated from the vial into the syringe along with the drug, and could therefore be injected into joints unconsciously. There are no published reports on intra-articular injection of rubber particles available to date. However, embolisms after intravenous drug application was found to be related to vial coring, indicating that intra-articular injections are at risk for vial coring associated complications including septic arthritis. Moreover a foreign body reaction could promote rapid destructive osteoarthritis.

An effective way to reduce vial coring by about 50% is an insertion angle of the aspiration needle into the vial at 45–60° . Unfortunately, this is difficult to implement into routine orthopedic practice due to safety reasons. Furthermore, a decrease of vial coring by 50% may not be sufficient.

Aims

This study aimed to analyze the frequency of vial coring in an orthopedic setting and to outline possibilities to avoid its occurrence.

Materials and Methods

Vials with a volume of 2 mL and the corresponding standard rubber stoppers were used for this experiment (total n = 800, n = 200 per group). Each vial was filled with 1 ml sterile sodium-chloride solution under sterile conditions and closed with a rubber stopper. Aspiration was performed through the stopper with the needle inserted exactly in the center at an angle of 90° .

In group one, aspiration from the vials was performed with a standard 18-Gauge (G) needle, and the same needle was used to eject the aspirated fluid onto a 10 µm filter paper of 2 × 2cm. In group two, an 18-G needle was used for aspiration. The needle was then replaced for a 23-G needle through which the fluid was ejected onto the filter paper. In group three a 23-Gauge needle was used for aspiration and ejection. In group four, aspiration was performed using 18-G needles with implemented 5 µm filters. Afterwards the needle was removed and the fluid ejected onto the filter paper directly out of the syringe.

The filter papers were transferred onto a transparent microscope slide. For quantification of rubber particles adhesive microscope slide grids (2 × 2 cm, grid distance 1 mm) were used. Subsequently, rubber particles were counted and measured using 20-fold magnification.

Results

In none of the 800 specimen, a rubber particle was detected by naked eye. Microscopically, 20 (10%) rubber particles were detected in group one, in which the 18-G needle was used for aspiration and ejection. In group two, in which 18- and 23-G needles were utilized, 21 (10.5%) particles were found. In group three, in which a 23-G needle was used for aspiration as well as for ejection 65 (33%) rubber particles were seen. In group four, where the 18-G needle with 5 µm filter was used for withdrawal of the fluid from the vial no particles were visualized.

The detected particles were mostly cylindrical with a mean length of 77 µm ranging from 29 to 214 µm. The mean width was 36 µm with a range from 14 to 83 µm in groups one and two were the 18-G needle was used for aspiration. In group three, in which the 23-G needle was used for aspiration the particles had a mean length of 55 µm ranging from 21 to 121 µm and a mean width of 32 µm with a range from 13 to 72 µm. Fig. 1 shows examples of the detected cores.

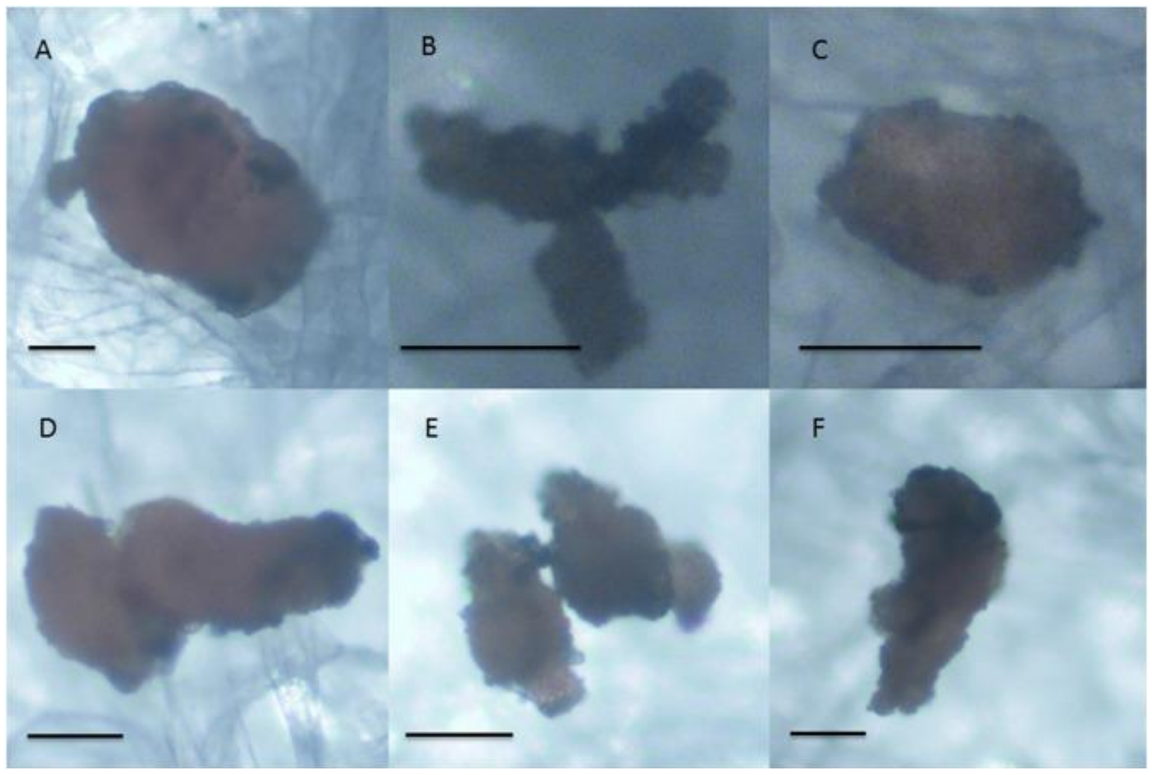

Figure 1. Microscopically detected rubber particles. Examples of the detected cores from group one (A–C) and group two (D–F). 2–4 particles tended to group on the filter paper (B, D, E). Scale 50 µm.

Conclusion

This study shows the occurrence of rubber particles in 10–33% of the cases, when standard needles are used for the aspiration of drugs. We therefore recommend using industrially prefilled syringes, filter needles (not possible when using particulate cortisone) or removing the rubber stopper before withdrawing drugs from vials for intra-articular injections.

References

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