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Review

Liquid handling, lidocaine and epinephrine in liposuction. The properly form☆

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ABSTRACT

Introduction: Fluid mismanagement in liposuction leads to pulmonary edema in a previously healthy individual. Pulmonary edema is considered the third cause of death in plastic surgery after PTE and lidocaine toxicity. The most important risk factor leading to this outcome is inadequate knowledge of fluid management and poor communication between the surgeon and the anaesthetist.
Objectives: To review the causes leading up to pulmonary edema in liposuction and the valid options for correct fluid management.
Methods: Non-systematic review of the literature in PubMed and Medline.
Results and conclusions: Correct fluid management in liposuction is based on a close communication between the surgeon and the anaesthetist in order to keep track of the total amount of subcutaneous fluid infiltration plus fluids delivered intravenously, always bearing in mind that infiltration fluids go to the central circulation.

Manejo de líquidos, lidocaína y epinefrina en liposucción. La forma correcta

Palabras clave:
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RESUMEN

Introducción: El mal manejo de líquidos en liposucción, conlleva a edema pulmonar en un paciente previamente sano. El edema pulmonar se considera la tercera causa de muerte en cirugía plástica después del TEP y la Intoxicación por lidocaína. El principal factor de riesgo que conlleva a este desenlace es el desconocimiento en el manejo de líquidos y la mala comunicación entre el cirujano y el anestesiólogo.
Objetivos: Revisar las causas que llevan a edema pulmonar en liposucción y las opciones validas de manejo correcto de líquidos.

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Métodos: Se realizó una revisión de la literatura no sistemática en las bases de datos PubMed y Medline.

Resultados y conclusiones: El correcto manejo de líquidos en liposucción se basa en una estrecha comunicación entre el cirujano y el anestesiólogo para sumar los líquidos infiltrados a nivel subcutáneo y los colocados por vía venosa, siempre teniendo en cuenta que los líquidos de la infiltración pasan a la circulación central.

Introduction

Liposuction is the most common cosmetic surgery procedure performed in the United States[1] and also in Colombia. Advances in the techniques for infiltration, designed to allow placement of epinephrine in a solution, thus reducing bleeding during lipoaspiration, have enabled removal in large volumes during liposuction. This induces significant changes in fluid behaviour inside the compartment, with the risk of pulmonary oedema and heart failure.[2]

Added to the invention by Klein in 1987 of a tumescent solution that included 500–1000 mg of lidocaine plus 1 mg of epinephrine for every 1000 cc of NSS[3] (Fig. 1) and which is widely used today for subcutaneous infiltration, the risk of lidocaine toxicity is a reality and the second cause of death in plastic surgery according to the American Society of Plastic Surgeons (ASPS).

The biggest problem with these new infiltration techniques, in particular the super wet and the tumescent techniques is associated with the large infiltration volumes, at infiltration/aspiration ratios ranging from 1:1 in the super wet technique up to 2–3:1 in the tumescent technique.[4] This means that in a 3-litre liposuction, subcutaneous fluid infiltration may amount to 3–9 litres, and this fluid volume requires special consideration from the point of view of anaesthesia.

Methods

Non-systematic review of the literature using the PubMed and Medline databases, introducing key words in English like Fluid Management, Liposuction, pulmonary oedema, larger infiltration, Aspiration volumes. All the articles were read and other articles of the selected references regarding the topic were also queried. Overall, 151 references were selected using this methodology.

Review

The use of large infiltration volumes in the tumescent solutions increases the difficulty of anaesthetic management in liposuction significantly. The risk of hypervolemia, pulmonary oedema, epinephrine-related cardiovascular effects, and lidocaine toxicity is always present.[5]

The purpose of using infiltration solutions with 1 mg of epinephrine in 1000 cc of Hartman's or NSS is to reduce bleeding into the lipoaspirate down to less than 5% of the extracted volume.[6] This results in the ability to perform large-volume liposuction, with the ensuing complications. Some studies conducted by Burk and Vasconez[7] have shown the use of up to 10 mg of epinephrine at concentrations of 1:1,000,000 in healthy patients, with no deleterious effects from toxicity such as tachycardia and hypertension, although these megadoses may lead to fatal consequences in patients with underlying cardiac disease in whom no workup has been done.

The second problem, when Klein solutions are used, is the infiltration of high doses of lidocaine (500–1000 mg of 1% lidocaine for every 1000 cc of NSS). There are multiple studies in the world literature conducted in plastic surgery patients that show that very high doses of lidocaine (up to 35–55 mg/kg) could be safe[8,9] considering that the infiltration is applied to scarcely vascularized adipose tissue and, moreover, considering the additional vasoconstriction derived from the use of epinephrine in the dilution. These studies have shown a margin of safety in thousands of liposuction procedures performed, with no risk of toxic levels despite the high doses of infiltrated lidocaine.

As far as anaesthesia is concerned, the FDA only accepts maximum doses of 7–10 mg/kg. The ASPS has reported that lidocaine toxicity may be an important cause of death in plastic surgery and might account for some intra- and postoperative deaths resulting from cardiac arrest in conditions of normal oxygen saturation. However, this is very difficult to demonstrate because of the difficulty in measuring postmortem serum levels, something that is usually done late or not done at all. It is worth noting that the use of high lidocaine doses has enabled dermatologists and surgeons to perform liposuction in their offices using local anaesthesia without the support of an anaesthetist, with the sole purpose of lowering the costs associated with the use of the operating room and the support of the anaesthetist. For this reason, our recommendation, when large quantities of lidocaine are used for infiltration, is that an anaesthetist must be present in the room and must be prepared to manage lidocaine toxicity-related cardiac arrest. Additionally, 20% lipids must be available in the room as the only effective measure to revert cardiac arrest while waiting for resuscitation. Fig. 2, shows the protocol for the management of local anaesthetic toxicity-related cardiac arrest, endorsed by the American Society of Regional Anaesthesia and the American Society of Plastic Surgeons, and published in www.lipidrescue.org together with the supporting literature.

The third issue relates to the large volumes of infiltrated fluids and volume overloading: in a 4-litre liposuction, subcutaneous fluid infiltration may be as high as 12 litres.