

CONTRAST MEDIUM EXTRAVASATION AND ITS EPIDEMIOLOGICAL PATTERN: A RETROSPECTIVE STUDY

Renan Machado Martins

Institution: ``Centro Estadual de
Reabilitação e Readaptação Dr. Henrique
(CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/6034170654764319>

Itylla Nayara Ribeiro Freire

Institution: ``Centro Estadual de
Reabilitação e Readaptação Dr. Henrique
(CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/9638959637443226>

Isabela de Freitas Dias

Institution: ``Centro Estadual de
Reabilitação e Readaptação Dr. Henrique
(CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/9518501540544285>

Débora Goerck

Institution: ``Centro Estadual de
Reabilitação e Readaptação Dr. Henrique
(CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/4324418132569657>

Brainer Vinnicius Campos Barbosa

Institution: ``Centro Estadual de
Reabilitação e Readaptação Dr. Henrique
(CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/7123452132385323>

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



Felipe Andrade de Paula

Institution: ``Faculdade de Medicina da Universidade de Rio Verde`` (UniRV)
Aparecida de Goiânia - Goiás
<http://lattes.cnpq.br/6367420743039992>

Thiago Oliveira Costa

Institution: ``Centro Estadual de Reabilitação e Readaptação Dr. Henrique (CRER)
Goiânia - Goiás
<http://lattes.cnpq.br/9990427425642115>

Daniela Pereira Azevedo

Institution: ``Centro Estadual de Reabilitação e Readaptação Dr. Henrique Santillo`` (CRER)
Goiânia - Goiás

Gilliard Martins de Oliveira

Faculdade Unida de Campinas (FacUnicamps)
Goiânia - Goiás
<http://lattes.cnpq.br/5819834923750729>

Abstract: Contrast medium extravasation (CME) refers to the leakage of intravenous administration into adjacent soft tissues, which may cause tissue injury or destruction. This study aims to evaluate risk factors, conduct and post-event evolution.

An epidemiological study of CME cases was carried out in a public health unit in Goiás, Brazil, and their evolution. The indicator parameterization sheets were evaluated, carried out every month by the hospital health team, in the period between 02/01/2022 and 12/31/2022, in which there is a description of the number of exams performed, the number of CME, in addition to the profile of affected patients.

A total of 4,078 contrast exams were performed, 1,646 of which were computed tomography (CT) with the administration of non-ionic, low-osmolality iodinated contrast (Ioxol) and 2,432 Magnetic Resonance Imaging (MRI) with the administration of non-ionic, linear gadolinium contrast (gadodiamide). There were twelve extravasations on CT and one on MRI (0.3% of exams performed). Of these thirteen patients, twelve had at least one risk factor for CME, being those related to the patient: age over 60 years (30.7%), hospitalized (23%), female sex (46.1%) and general pathologies (69.2%), highlighting difficult-to-control systemic arterial hypertension, stroke, Crohn's disease, oncological disease, Fahr's disease and deep vein thrombosis. The risk factor for CME directly related to the technique was automatic injection in 100% of CT cases. The case of the only patient without known risk factors for CME encouraged training for the entire healthcare team involved. The cases were followed up without any reports of unfavorable evolution.

To know the prevalence and nature of CME cases allows the evaluation of the institutional epidemiological profile, in addition to improving the training of the health team.

Keywords: contrast extravasation; risk factor for CME; iodinated contrast; gadolinium contrast; imaging exams

INTRODUCTION

Radiological contrast media for intravenous use are substances typically composed of iodine and gadolinium, used to improve the visibility of internal body structures in imaging techniques, notably in Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). In recent decades there has been a considerable increase in its use, with the aim of detecting, evaluating and staging various disorders.

Despite the benefits of intravenous injection in the evaluation of specific cases, this procedure may present risks, although infrequent. Among them is contrast medium extravasation (CME), defined as the leakage of contrast medium administered intravenously, which presumably must remain inside the vessel, into adjacent soft tissues, potentially causing tissue injury or destruction.

The occurrence of CME is infrequent and its incidence may vary mainly according to the type of contrast medium administered. There are reports in the literature of an incidence ranging from 0.1% to 0.9% for iodinated contrast media, and from 0.03% to 0.06% for gadolinium-based contrast media. The lower incidence of gadolinium-based CME, approximately six times lower compared to iodinated contrast media, has been attributed to associated cofactors, such as low volume of contrast used, low injection rates and greater use of manual injection.

Most contrast extravasations cause mild reactions, such as minimal local swelling or erythema. However, with extravasation of large volumes, skin necrosis, ulceration and compartment syndrome may occur.

Preventive measures to avoid these complications can be taken, such as the use of

non-ionic contrast (low osmolarity), careful choice of the intravenous administration site and close monitoring of the patient during contrast injection. Furthermore, guidance to patients to immediately recognize the complication can minimize or prevent extravasation injuries.

A considerable part of CT and MRI exams require the use of intravenous contrast for successful diagnosis and, consequently, better patient care. This use must be based on an excellent assessment of its risks and benefits. Therefore, the occurrence of adverse events such as CME is part of the radiological routine and must be promptly recognized and appropriately treated, and the team must be prepared to manage the situations that arise, since severe complications can occur and consequently lead to an increase in morbidity and mortality and hospital stay. Based on this maxim, an epidemiological study was carried out to evaluate how this production of care has occurred within a Brazilian public health unit, aiming to evaluate the risk factors of this event, the conduct and post-event developments.

METHODS

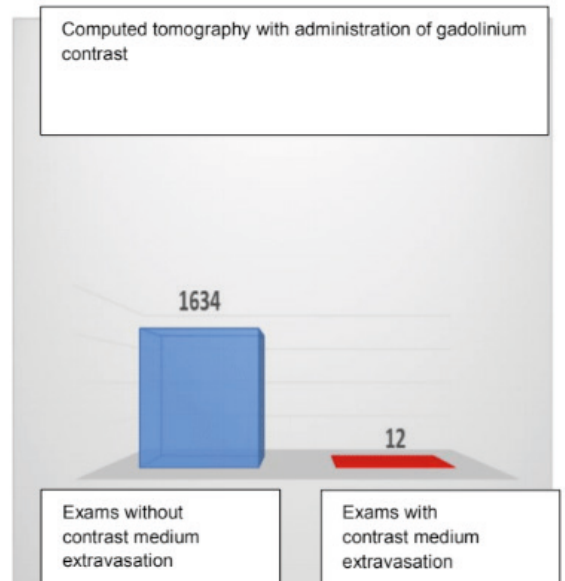
An epidemiological study of CME cases was carried out in a public health unit in Goiás, Brazil, as well as their evolution. The indicator parameterization sheets were evaluated, carried out every month by the hospital health team, in the period between 02/01/2022 and 12/31/2022, in which there is a description of the number of contrast exams performed, the number of health events CME, in addition to the profile of affected patients.

RESULTS AND DISCUSSION

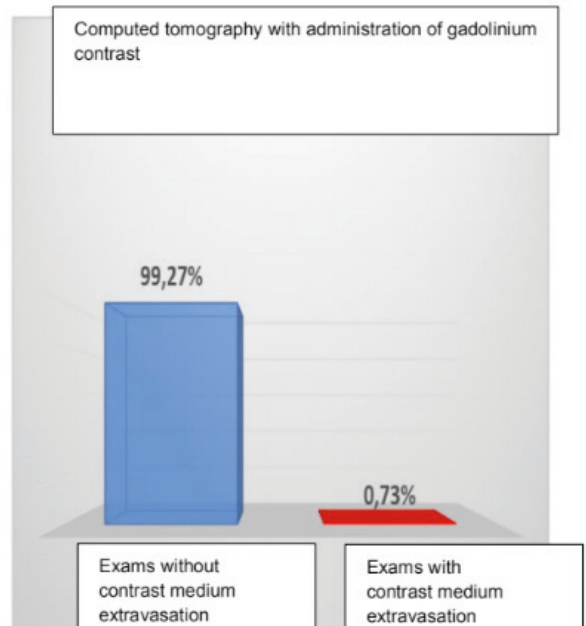
4078 contrast exams were performed, 1646 Computed Tomography (CT) with administration of non-ionic, low osmolality iodinated contrast (Ioxol) and 2432 Magnetic Resonance Imaging (MRI) with administration of non-ionic and linear gadolinium contrast (Gadodiamide).

All patients underwent a prior assessment in search of currently known risk factors for the contrasts in question, including: previous allergic episode or uncertain manifestation to a contrast medium; asthma; renal insufficiency. However, the only factors that absolutely contraindicated contrast injection were: Glomerular Filtration Rate < 30 mg/dL; history of a previous severe allergic reaction to contrast media (such as anaphylaxis and laryngeal edema, for example). This assessment was carried out jointly, both by the nursing technician and nurse in the sector, as well as by radiology technicians and radiologists. Added to this, the patient was informed of the risks of the exam and actively participated in the decision-making process on whether or not to use contrast.

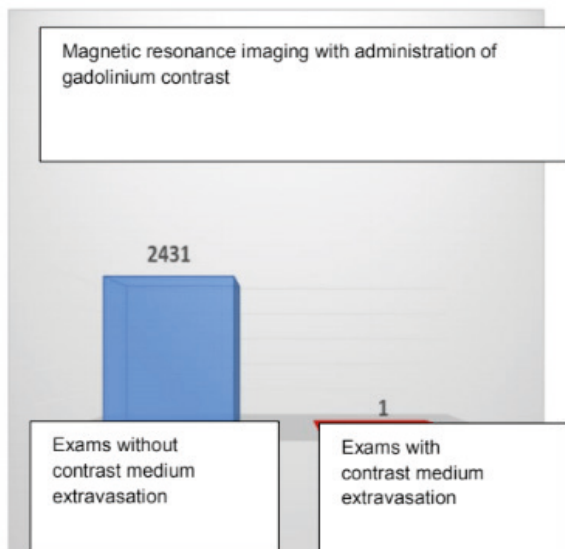
There were twelve extravasations on CT and one extravasation on MRI, totaling around 0.3% of the tests performed. Of the computed tomography scans using contrast, around 0.73% had an episode of extravasation (Graphic s 1 and 2). Extravasation occurred in approximately 0.04% of MRIs using contrast (Graphic s 3 and 4).



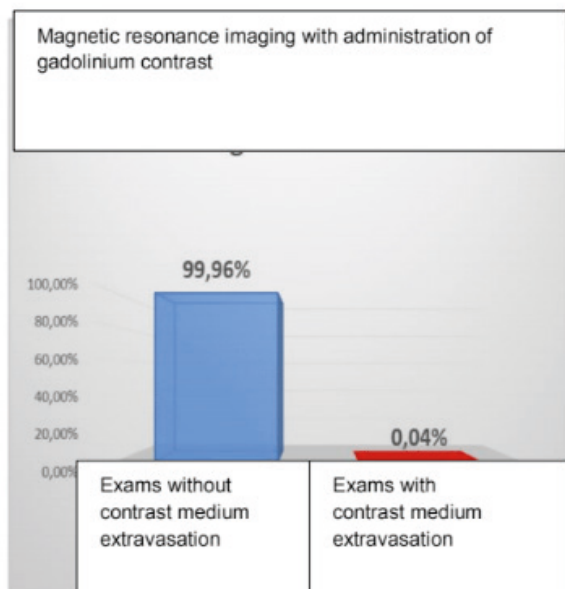
Graph 1: Exams and without extravasation of iodinated contrast media (EMC) (non-ionic and low osmolality), carried out at the institution, from February to December 2022, in absolute numbers. There were 2 episodes of CME in tomographic examinations



Graph 2: Exams with and without extravasation of contrast media (EMC), iodinated (non-ionic and low osmolality), carried out at the institution, from February to December 2022, in percentage numbers. There were 12 episodes of CME in 0.73% of tomographic exams.



Graph 3: Exams with and without extravasation of contrast media (CME), gadolinium (non-ionic and linear), carried out at the institution, from February to December 2022, in absolute numbers. Only 1 episode of CME occurred.



Graph 4: Exams with and without extravasation of contrast media (CME), gadolinium (non-ionic and linear), carried out at the institution from February to December 2022, in percentage numbers. CME occurred in only 0.04% of exams using gadolinium.

In total, therefore, there were thirteen episodes of contrast extravasation at the institution during the period evaluated. Of these thirteen episodes, twelve occurred in patients with at least one known risk factor for CME. When grouping all the risk factors evaluated and present in these cases (as illustrated by Graphic 5), we have the following:

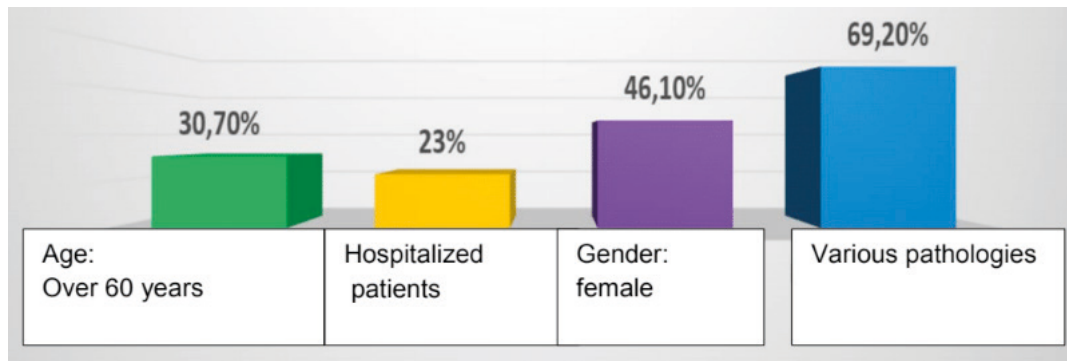
- 30.7% of patients evaluated were over 60;
- 23.0% of patients were hospitalized;
- 46.1% were female;
- 69.2% had at least some diagnosed comorbidity. Of these comorbidities, the following stood out: difficult-to-control systemic arterial hypertension; chemotherapy/radiotherapy treatment; breast cancer; Crohn's disease; Fahr's disease; sickle cell anemia; tetraplegia; pressure ulcer; tuberculosis; dehydration/diarrhea; history of deep vein thrombosis and peripheral arterial obstructive disease; stroke sequelae.

It is noteworthy that in all computed tomography exams there was automatic injection of iodinated contrast medium, using an injection pump, considered in itself a risk factor directly related to the exam technique.

Therefore, a higher prevalence of CME was noted in exams using iodinated contrast (non-ionic and low osmolality), to the detriment of exams using gadolinium contrast (non-ionic and linear). The only case of extravasation that occurred with gadolinium contrast was in a patient with more than one associated risk factor: he was 71 years old, had tissue fragility and reduced mobility due to an ischemic stroke, with right hemiparesis.

Of the thirteen episodes of extravasation, therefore, only one had no known risk factors for CME. This, in turn, encouraged training for the entire healthcare team involved.

All cases evaluated were followed up without any reports of unfavorable evolution,



Graphic 5. Most common risk factors for contrast media extravasation occurring at the institution, from February to December 2022.

after correctly following the CME protocol based on international recommendations from the American College of Radiology.

CONCLUSION

To know the prevalence and nature of CME cases allows the assessment of the

institutional epidemiological profile, in this case compatible with the literature analyzed, in addition to improving the training of the health team through the assessment of risk factors and the feasibility of the CME protocol used in the institution.

REFERENCES

- BEHZADI, Ashkan Heshmatzadeh et al. **MRI and CT contrast media extravasation**. *Medicine*, v. 97, n. 9, p. e0055-e0055, 2018.
- BELZUNEGUI, Tomas et al. **Extravasation of radiographic contrast material and compartment syndrome in the hand: a case report**. *Scandinavian journal of trauma, resuscitation and emergency medicine*, v. 19, n. 1, p. 1-4, 2011.
- BIRNBAUM, Bernard A. et al. **Extravasation detection accessory: clinical evaluation in 500 patients**. *Radiology*, v. 212, n. 2, p. 431-438, 1999.
- DUTRA, Bruna Garbugio; BAUAB JR, Tufik. **Meios de Contraste**. Sociedade Paulista de Radiologia.
- MANDLIK, Veronika; PRANTL, Lukas; SCHREYER, Andreas G. **Contrast media extravasation in CT and MRI—A literature review and strategies for therapy**. In: *RöFo-Fortschritte auf dem Gebiet der Röntgenstrahlen und der bildgebenden Verfahren*. Georg Thieme Verlag KG, 2019. p. 25-32.
- MANUAL, A. C. R. **On contrast media**. 2020.
- SAUERLAND, Carmel et al. **Vesicant extravasation part I: Mechanisms, pathogenesis, and nursing care to reduce risk**. In: *Oncology nursing forum*. 2006.
- SILVA, Hernandes Cerqueira de Souza; BITENCOURT, Almir Galvão Vieira; CHOJNIAK, Rubens. **Avaliação do extravasamento do meio de contraste iodado em pacientes oncológicos submetidos a tomografia computadorizada**. *Radiologia Brasileira*, v. 51, p. 236-241, 2018.
- UPTON, Joseph; MULLIKEN, John B.; MURRAY, Joseph E. **Major intravenous extravasation injuries**. *The American Journal of Surgery*, v. 137, n. 4, p. 497-506, 1979.