



POST COVID AVASCULAR NECROSIS OF FEMORAL HEAD AND ROLE OF MRI HIP IN MAKING DIAGNOSIS

Radiology

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ABSTRACT

One of the important factors of COVID-19 pandemic was the life saving drug – corticosteroids. During the year long pandemic the actual guidelines for the treatment lacked consistency. Hence the usage of intravenous corticosteroids has fluctuated well beyond the rational limits under different clinical settings. We are here to discuss one of the well known side effects of this class of drug, the avascular necrosis. In the current study we have covered its classic location avascular necrosis of femoral head. The hip joint is one of the most important weight-bearing joint with considerable mobility. The pathologies affecting the hip joint result in significant morbidity in day to day life. MRI hip has been an important imaging tool for screening, staging and follow up scanning of avascular necrosis of femoral head. In the current study we will discuss about the post COVID 19 avascular necrosis of femoral head following the standard treatment with corticosteroids with the help of MRI scan of hip joints.

KEYWORDS

COVID 19, Corticosteroids, Avascular necrosis, MRI, Hip joint.

The occurrence of bone death following reduced blood supply or complete stoppage of blood supply is known as avascular necrosis (AVN). The affected part then follows disintegration and eventually collapses. The femur is one of the commonly affected bones. Excess use of corticosteroids is one of the most common medical causes of AVN. Usual clinical features are of gradually increasing pain and reducing the range of movement. Treatment options vary from physiotherapy to medications and surgery if needed. [1]

As of now a total of 664,618,938 confirmed COVID-19 cases, including 6,722,949 deaths, have been reported worldwide to the World Health Organization. About 6,722,949 confirmed cases and about 530,737 deaths are reported in India according to World Health Organization. Yet there is no significant data has been collected for the incidence of AVN of femoral head following the treatment which is called the life saving drug in COVID- corticosteroids.

This retrospective study was done to study the spectrum of AVN of the femoral head in patients treated for COVID-19 with corticosteroids with use of MRI scan of hip.

MATERIAL AND METHODS

This retrospective observational study was approved by the Institutional Ethical Committee.

Patients, who had been treated for COVID-19 and developed hip pain within 6 months from May to December 2022, were included using the following criteria:

- Positive RT-PCR for SARS-CoV-2 sampled with nasopharyngeal / oropharyngeal swabs or positive RAPID antigen test for COVID-19
- Received standard treatment with steroids during the clinical phase of COVID-19
- New-onset hip pain within 6 month period without any pre-existing hip conditions

A total of 100 patients were selected for the study (Ranged from 22 to 71 year age). Scans were done using anterior multichannel 1.5 T GE MRI machine.

The clinical, demographic and imaging parameters of all patients were recorded and analyzed.

Evaluation of MRI Images

The Ficat and Arlet classification system for grading of femoral head AVN [3]

Stage 0: Normal

Stage I: Edema

Stage II: Geographic defect

Stage III: Crescent sign and eventual cortical collapse

Stage IV: End-stage with evidence of secondary degenerative changes.

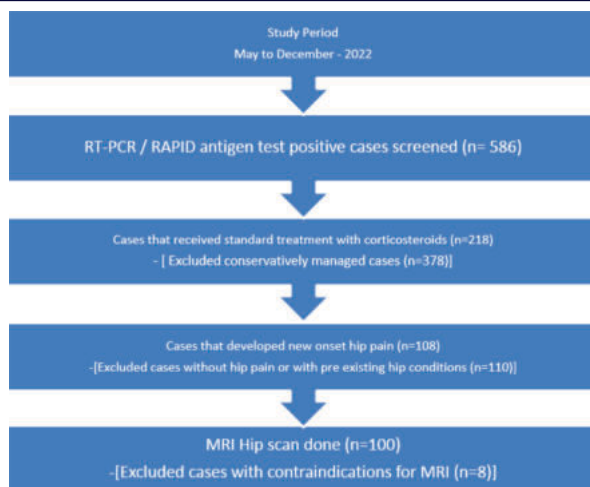


Figure 1: flow diagram of selection of cases

Most Common Features Of AVN On MRI

- Diffuse edema
- Focal serpiginous low signal line with fatty center
- Double line sign
- Focal sub-chondral low signal on T1 with variable signal on T2

Table 1 Showing Demography And Clinical Features.

Criteria		Male	Female	Total
Gender		77	23	100
Symptoms	Fever	10	6	16
	Hip pain	77	23	100
	Backache	36	15	51
	Limited range of motion	8	3	11
Comorbidities	Diabetes	18	9	27
	Hypertension	7	11	18

STATISTICAL ANALYSIS & RESULTS

- A total of 100 cases fitting the inclusion criteria.
- The Mean age - 49 years (Range- 21 to 72 years).
- Standard deviation - 10 years.
- Mean interval of 6-8 weeks between onset of hip symptoms and MRI scan.
- AVN stage I - 6% cases (Age group <40 years).
- AVN stage II - 4% cases. (Age group 40–60 years).
- AVN stage III- 2% cases. (Age group >60 years of age).
- AVN stage IV - 0% cases.
- No positive findings to suggest AVN was seen in 88 % cases.

DISCUSSION

Corticosteroids were and are being widely used as a life saving medication for COVID-19 pneumonia. After the recent pandemic one of the side effect of corticosteroid usage is development of avascular necrosis of bones, among them AVN of femoral head tops the charts. It is also known as steroid-induced AVN of the femoral head.

Harvey Cushing first recognized the adverse effects of hypercortisolism on bone tissue in the early 1930s. Since then, multiple reports of bone death have increased our awareness of the potential for the development of osteonecrosis in patients on corticosteroids [5]. Early diagnosis has proven to be problematic as the majority of patients are asymptomatic until significant damage to bone has occurred. Osteonecrosis tends to occur in a younger, more active age group. Since there are limited treatment options for advanced disease, early identification is vital.

There is a lack of consensus about the dosage and duration of steroids required to develop AVN. Some authors have reported that a cumulative dose of 2000mg prednisone (or its equivalent) was required for AVN development. [7] Some studies have shown that 700mg is the minimum dose required to develop AVN. [8] However, McKee et al have shown that in their series of 15 patients who developed AVN, mean steroid dose in prednisone equivalents was 850mg with a range of 290 mg–3300 mg. [9] Dose of corticosteroids in our study ranged from 450 mg to 1300 mg.

MRI is an excellent modality in diagnosis, staging, deciding the extent, severity and complications and predicting prognosis of AVN of the femoral head being far superior to radiography in all terms (except the cost and when prosthesis causing contradiction for MRI hip). It can routinely detect early AVN in asymptomatic patients with negative radiographs. MR imaging should be the procedure of choice for screening those patients at great risk for the development of AVN. MRI being multi-planar shows extent of involvement of weight bearing area and total involvement of head of femur better and accurate than X-ray which is very useful in predicting the prognosis of AVN.

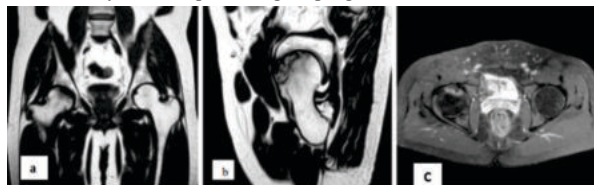


Figure 2: Image (a) & (b), respectively coronal and sagittal T1 weighted images showing focal hypo intensity involving head of right femur with subtle hyperintense demarcating rim on STIR Image (c).

Misinterpretation of osteonecrosis on MRI may occur if one is unfamiliar with a few potential pitfalls like Fovea Centralis, Hematopoietic Marrow, and Synovial herniation pit.

As per Ficat and Arlet classification system the grading ranges from stage 0 to stage IV. The stage 0 is also known as silent hip. Stage I, II & III can be managed with conservative treatment with medications like Bisphosphonates. Stage IV would require surgical intervention like arthroplasty. Hence the use of a “therapeutic checklist”, such as that proposed by Weldon et al. [6], may be a useful means of identifying those patients at particular risk and minimizing the use of steroids.

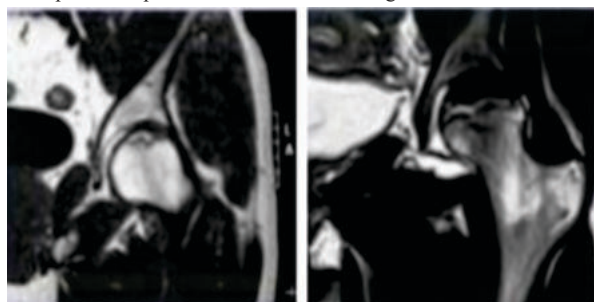


Figure 3: On T1 weighted image (on left) , the band like hypo-intensity indicating ischemic marrow signal and on T2 weighted image (on right) , hyperintense line internal to the T1 hypo-intense line seen on left sided image which represents the hyper vascular

reparative granulation tissue. This sign is known as Double line sign.

Limitations Of The Study

The study is limited due to lack of follow up scans. Also the fact that the cases received the COVID treatment in different clinical settings with each of their own set of other comorbidities. There are also reports preferring the use of BOLD-MRI in order to pick up the changes of AVN of femoral head over conventional MRI [10]. That can't be possible due to lack of availability. The correlation between radiological findings and histopathological results couldn't be achieved because of difficulties getting femoral head biopsy permissions.

CONCLUSION

Considering the extent of usage of corticosteroids during the recent pandemic of COVID, the healthcare facilities have to be aware and be prepared for the imminent increase in the incidence of AVN of femoral head since it being the side effect amongst others. AVN of femoral head if overlooked can progress to the end stage disease and cause the considerable amount of morbidity in patients returned to their daily life activities. Rational combination of clinical examination, radiography and MRI imaging can help picking it up early providing the scope for efficient treatment and limiting the morbidity.

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