Particular ultrasound findings in AML (acute myeloid leukemia)

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Learning objectives

Being a malignant systemic disease with a fulminant evolution, AML puts radiologist in front of a challenge, that’s why we should know what to expect to find in a patient diagnosed with AML and be ready to use ultrasound as the first choice option.

The purpose of this work is to understand the pathogenesis of organs affected in AML and their ultrasonographic appearance based on case reports and medical studies. Also to realize the importance of considering a granulocytic sarcoma (GS) as an extramedullary myeloid tumor which is known to accompany, even precede, the development of AML.

Background

AML it’s a critical malignant hematological disease which can develop in every age group, mainly in adults and beyond age 60. It’s gravity it’s due to massive proliferation of abnormal white cells, inhibiting the production of normal cells. As a result, leukemic cells are spilling in the blood producing leukostasis, predisposing to thrombosis, and infiltrating various organs causing non-specific symptoms. [1]

According to the FAB (French - American - British) classification system, there are 8 types of AML. Some of this subtypes are linked with certain organ involvement or with myeloid sarcoma (LAM M2).[2] To asses a possible spread of the disease to this organs, is needed to complete the primary diagnostic with imaging. [1] As ultrasound is a method with many advantages, we can use it to evaluate the following organs involved:

- Hepatomegaly or splenomegaly due to leukemic infiltration is a common feature in AML M5. So, on ultrasound, we expect to find changes not only in size but also to observe modified ultrasonic characteristics of parenchyma. More then that, the echo-structure of the liver depends on the chemotherapy conducted. [9] Besides the infiltration, liver and spleen may be the place for a GS that can appear as multiple well-defined solid masses and are indistinguishable from multiple hepatic metastases or abscesses.
- Gallbladder involvement is rare [5], but should be considered a differential diagnosis in a leukemic patient with imaging evidence of gallbladder inflammation in absence of gallstones. [6]
- M4 is associated with kidneys enlargement, without involvement of perinephric space, which is seen in lymphoma. [4]
- Even though transabdominal ultrasound of the gastrointestinal tract (GI) have some relevant limitation, it provides more detailed information on bowell wall layers than CT, therefore, a possible infiltration of stomach, ileum
and proximal colon, show thickening of the bowell wall [3] with reduced echogenicity, changes, that in some patients, disappear after chemotherapy. As a frequent site of involvement, there are mentioned cases of small intestinal obstruction with intussusceptions due to a granulocytic sarcoma. [2]

- Pancreas, prostate, testes, lymph nodes, muscle and skin are rare cases affected by GS.

For a reliable diagnostic, a radiologist should always correlate the imagistic findings with hematological parameters to help establish a promptly treatment, as the prognosis is very poor once the extramedullary spreading is detected.

**Imaging findings OR Procedure details**

GS involving the testis is very uncommon, till year 2005, were reported 9 cases, mostly as a relapse of LAM. [7] Our patient, a 61 years old male, known with LAM M5, presented in our clinic for a hematological evaluation. On clinical exam, was found enlarge right testicle, painful on palpation and spontaneously. Sonographically, among infiltrated, low echogenic tissue (Fig. 1 on page 4, Fig. 2 on page 5) with significantly pronounced vascularization (Fig. 3 on page 6, Fig. 4 on page 7), we found a range of normal echogenic parenchyma of about 2,3 cm, with at least two nodular hipoehogenic images included of 5 mm, well defined, regular borders with a positive Doppler signal. Increased size epididymis. Left testicle ultrasound showed similar nodular lesions, hipoehogenic, also vascular (Fig. 5 on page 8). At this level, vascular paths have high resistivity index suggestive of infiltrative nature of the lesion (Fig. 6 on page 9). After a biopsy was performed, GS was confirmed.

Second case of a 24 years old female, was admitted in our hospital presenting right iliac fossa pain, vomiting, asthenia and fatigue. Acute appendicitis was suspected. After a blood workup, was revealed severe anemia, thrombocytopenia and leukocytosis. In hematological clinic, she was diagnosed with LAM. Abdominal ultrasound was not suggestive for an appendicular plastron, instead we observed that bowell wall from the level of the cecum and ascendant colon was thickened up to 1,5 cm, in patches with polinodular appearance, proliferative; also enlarged mesenteric lymph nodes in right lower quadrant (Fig. 7 on page 10, Fig. 8 on page 11, Fig. 9 on page 12, Fig. 10 on page 13, Fig. 11 on page 14). Because of her persisting GI symptomatology, even after a chemotherapy treatment, was performed a colonoscopy that described an infiltration of the colonic wall and hemorrhagic areas. A superficial biopsy was made because of her sever thrombocytopenia; histopathology results described only inflammatory lesions, however, due to her worsened general condition, she died in less than a week. Gastrointestinal manifestations of leukemia occur in up to 25 % of
patients at autopsy (Journal of Gastroenterology and Hepatology Foundation, 2012). Gross leukemic lesions are most common in the stomach, ileum and proximal colon; patients presenting vague abdominal pain and/or obstruction. Lesions in the small and large bowell are usually hemorrhagic or infiltrative and the main GI causes of death in leukemia are infection, necrotizing enterocolitis and hemorrhage. [3] Even in our case, wasn't confirmed GI involvement, clinical manifestations and imaging are highly suggestive for a proliferative leukemic lesions.

Another similar case of a 53 years old female, diagnosed with LAM with no significant GI symptoms, reveled on ultrasound a loop of small intestine with important thickened wall prone to intussusceptions and moderate infiltration of mesentery (Fig. 12 on page 15, Fig. 13 on page 16, Fig. 14 on page 17, Fig. 15 on page 18). After one month of chemotherapy, check-up ultrasound showed no pathological modifications.

GS of the spleen is also reported in literature as a site of involvement, difficult to differentiate from splenic abscess, given that the leukemic patient is susceptible to infection. We have a case of a 65 years old male, known with LAM, presenting with malaise and abdominal pain in left upper quadrant. On ultrasound we found many hyperechogenic splenic areas up to 1,5-2 cm, which outlines nodular features, associated with intensehipoechogenic areas, almost transonic up to 2 cm (Fig. 16 on page 19, Fig. 17 on page 20, Fig. 18 on page 21).

Some other cases that we have with LAM associates suspicious nodular lesions in submandibular glands and thyroid. In medical literature, there are mentioned cases of GS in submandibular gland and thyroid, but they are extremely rare.

Images for this section:
Fig. 1: Right Testis
Fig. 2: Right Testis
Fig. 3: Doppler Right Testis
**Fig. 4:** Doppler Right Testis
Fig. 5: Left Testis
Fig. 6: Doppler Right Testis
Fig. 7: GI infiltration
Fig. 8: GI Infiltration
Fig. 9: GI Infiltration
Fig. 11: GI Infiltration
Fig. 12: Mesentery infiltration
Fig. 16: Spleen
Fig. 17: Spleen
Fig. 18: Spleen
Conclusion

Ultrasound findings in LAM are nonspecific, and because of the great variety of structures involved, there is considerable risk for misdiagnosis and delay in therapy [8], therefore, early recognition by a radiologist of leukemic infiltration or a GS is necessary so as to assure prompt administration of appropriate chemotherapy. [5] Also, due to it's poor prognosis, it is crucial for a radiologist to consider and to report suspected granulocytic sarcoma.

References

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