

ESWT in Bone Marrow Edema: When and Why ....

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Bone Marrow Edema (BME) cannot be considered a clinical entity as it is a nonspecific and uniform pattern of reaction in bone and its vascular supply, to various external or internal disturbances. It is a descriptive term for a common finding in magnetic resonance imaging as “inflammation – like” pattern: “low intensity signal” in T1 sequences, associated with an “intermediate - high intensity signal” in T2.

At the tissue level, signs of hypervascularity and repair activity have been described, related to local high bone turnover. From the histological point of view, all findings described in the literature are in line with the notion that BME represents repair phenomena, elicited by inflammatory or non-inflammatory “trauma” to the bone.

More recently, as histological analysis were unable to demonstrate oedematous changes at the tissue level, in the vast majority of cases, the alternative term of Bone Marrow Lesions (BMLs) has been introduced.

From the pathophysiological point of view, it is possible that an ischemic noxious or tissue stimuli can activate the so – called “Regional Acceleratory Phenomenon” (RAP), characterized by increased blood flow and tissue remodeling activation, with loss of bone homeostasis and the risk of possible ischemia.

Identification of the underlying cause of painful BME is the paramount prerequisite for initiating the appropriate treatment.

According to the Ludwig Maximilians University (LMU) Consensus classification, based on the etiology, 8 main groups can be recognized: traumatic, septic, primary inflammatory, mechanical-degenerative, neoplastic, ischemic/neurogenic, metabolic and “diagnosed for exclusion”.

Although pain is the major symptom, BME differs in terms of its causal mechanisms, underlying disease, as well as treatment and prognosis; this complexity, together with the lack of evidence-based guidelines, frequently makes the identification of underlying conditions and its management a major challenge. Unnecessary multiple consultations and delays in diagnosis and therapy indicate a need for interdisciplinary clinical recommendations. For this reason, interdisciplinary management of BME is recommended, with a task force consisting of specialists from internal medicine, endocrinology/diabetology, hematology/oncology, orthopedics, pediatrics, physical medicine, radiology, rheumatology and trauma surgery.

With the exclusion of septic, inflammatory, neoplastic and metabolic forms, all the causes can be treated successfully with 3 main groups of therapies: physical modalities, surgical treatments and pharmacological options.

Extracorporeal Shock Waves Therapy (ESWT) can be considered one of the best physical modalities, in terms of efficacy, safety, and patient compliance.

According to the ISMST Consensus Statement, BME is included in the group of “Common empirically – tested uses” (bone section); nevertheless, as part of the diseases, also BME in stress fractures (as “bone stress injuries”), avascular bone necrosis without articular derangement, osteochondritis dissecans, as well as some insertional tendinopathies can be successfully treated with SW.

In clinical practice, only focal SW are indicated for treating BME, and “targeting” with US probe is necessary, not only for deep and large bones (as the femoral head), but for the smallest ones as well. For the hip and deepest bones is necessary to use a bigger lithotripter, applying medium – high energy treatments (EFD 0.15 – 0.50 mJ/mmq, more than 3000 shots/ session) for a total of 3 sessions (1 cycle, repeteable) at weekly interval; for smallest and more superficial bones, smaller lithotripters with handle source are enough, at lower energy protocols (low – medium energy treatments) (usually EFD not over 0.30 mJ/mmq) at weekly intervals.

In spite of the large amount of articles in the literature, confirming SW, in clinical practice, as a valid conservative strategy for BMEs, little is known about the mechanisms of action of SW in these bony disturbances. It is well known in any case that SW have “multilevel” effects on bone: direct stimulation of osteogenesis (through the osteoblastic lineage) and vascularization, but also inhibition of osteoclastogenesis (although, until now, only “in vitro”). It has been hypothesized that, by applying SW in condition of up – regulated bone turnover, as visible in BME syndromes, in some ways, we could “regulate” local bone metabolism, by blocking, at first, bone resorption.

By positively interphering on BMLs, ESWT can be considered a very promising strategy for treating some osteoarticular diseases, where altered subchondral bone turnover has a key – role in the pathogenesis and evolution of the osteochondral degeneration.

Nevertheless, in clinical practice, it is fundamental, when ESWT are prescribed for BML, as first step, to do differential diagnosis with tumors (mainly osteoid osteoma), infections and reumathic diseases.

In summary, we can conclude that:

- by positively interphering on altered bone turnover (RAP), SW can represent a valid therapeutical strategy in BME resolution, not with «palliative» but «curative effect»;
- persistent pain, not responsive to common therapies should always make you suspect the presence of BML;
- precise diagnosis is required before planning treatment (be aware of tumors and systemic diseases);
- SW treatment must be personalized and applied with adequate device; targeting is mandatory;
- BMLs take time to heal (several weeks or even months) and in some cases with “restitutio ad integrum”.