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EVALUATION OF GALS AND MODIFIED GALS IN PATIENTS WITHOUT PRIOR MUSCULOSKELETAL SYMPTOMS

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ABSTRACT

Musculoskeletal (MSK) symptoms are the most common health disorders requiring medical attention, and accounting to 20% of both primary care and emergency-room visits. MSK symptoms do not receive proper teaching attention. Over the past two decades, rheumatologists from around the world have not only championed the musculoskeletal system examination but also modified the undergraduate teaching curriculum. This has led to the development and adoption of the gait, arms, legs and spine (GALS) screening along with regional examination techniques. This study was designed to evaluate the ability of the GALS examination to detect abnormalities in patients without musculoskeletal symptoms and to study whether particular modifications in the GALS can improve the sensitivity. Clinical case-series collection. The study has been conducted at the rheumatology clinic of Ibn-Sina teaching hospital, on one hundred adult males after taking their consent to participate in this study, their ages ranged between 30 - 50 years and they were not suffering from MSK complain after asking them the three questions which are the following:

- 'Do you have any pain or stiffness in your muscles, joints or back?'.
- 'Can you dress yourself completely without any difficulty?'.
- 'Can you walk up and down stairs without any difficulty?'.

Then doing screening examination of gait, arm, leg and spine.
The GALS examination was performed as previously described……
The modified GALS adopted the following modifications:

1. Using neck extension instead of lateral bending.
2. Using shoulder internal rotation instead of external rotation.
3. MCP extension was added to squeezing test.
4. Adding toe and heel walking to gait examination.
5. Adding jaw movement (tempromandibular joint).

The presence of locomotor abnormalities were found in 22 out of 100 adults by using GALS screen, gait abnormalities was 0%, while 9% showed arm abnormalities, 3% showed leg abnormalities, 10% showed spine abnormalities. When examining the same adults by using modified GALS (MGALS) screen, the locomotor abnormalities were found in 27%, gait 10%, arm 11%, leg 3% and spine 18%. The MGALS is significantly more sensitive than GALS in detecting abnormalities in gait and cervical spine (P-value 0.001, 0.04 respectively). In MGALS there is a significant positive correlation between abnormalities as following: cervical extension and shoulder internal rotation (r-value 0.613) , lumber movement and heel walking (r-value 0.696), knee abnormalities and toe walking (r-value 0.660), increasing age correlated positively with abnormalities in both cervical extension and shoulder internal rotation (r-value 0.503, 0.387 respectively). In GALS there is a positive correlation between cervical lateral bending and shoulder external rotation (r-value 0.241). Increasing age correlated with abnormalities in both cervical lateral bending and shoulder external rotation (r-value 0.299, 0.336 respectively). 1-GALS or its modification can detect abnormalities in asymptomatic patients. 2-GALS modification improves its detection of abnormalities. Clinical musculoskeletal evaluation needs major under- and post- graduate improvements.

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INTRODUCTION

Musculoskeletal (MSK) conditions are a major problem in society today, they are common amongst the general population and have been identified as a significant source of pain and disability worldwide (Bernstein *et al.,* 2011; Humphreys *et al.,* 2007), forming the single most important factor influencing disability in later life (Fox *et al*., 2000). Musculoskeletal disorders can impact on the presentation of other diseases, as a significant number of medical conditions are associated with locomotor manifestations as well as affecting rehabilitation and discharge planning (Lillicrap *et al*., 2003), so MSK disorders form a considerable part of the general practitioner workload, and therefore examination and assessment of the locomotor system is a common requirement for doctors in many areas of health care. This requirement is likely to increase as the proportion of elderly patients in the community expands, and as patient perceptions alter with respect to treatment and health care availability (Fox *et al*., 2000). All clinicians should be able to assess, by appropriate history and examination, a patient with musculoskeletal symptoms and the identification of the earliest signs of MSK conditions is crucial for improving their management (Arthritis Research Campaign, 2005). They must be alert in identifying potentially serious conditions, although most consultations will turn to be less serious though common problems; however, any problem is important to the patient (Woolf *et al*., 2008). Some musculoskeletal conditions can be managed in primary care, whereas other more complex or progressive conditions will require secondary care by a multidisciplinary team. Further competencies will be required at these different levels of care and by the different disciplines (Woolf and Akesson, 2008).

The aim of clinical assessment is to characterize the problem, establish the cause (if possible), and to assess the impact of the problem on the patient, family and care-givers. From this assessment, a plan for further investigation and management can be logically developed in partnership with the patient (Woolf and Akesson, 2008). There is a lack of ability in this core competency; primary care physicians do not always have adequate MSK knowledge and confidence, and patients are often dissatisfied following consultations, with their expectations not being met. Inadequate priority is given to musculoskeletal health in the curricula of many medical schools; a further issue is that the assessment of the MSK system is often taught differently by the various specialties involved in the management of MSK conditions; furthermore, Junior doctors appear to be poor at detecting such disorders. It has been suggested that this is owing to a combination of poor skills and failure to assess the locomotor system in general medical patients (Woolf and Akesson,2008), Within medical schools there is increasing emphasis on the acquisition of basic clinical skills at the undergraduate level (Doherty *et al*.,1992). In spite of all these facts, the MSKsystem is seldom appropriately assessed in everyday clinical practice and frequently neglected (Oswald *et al*.,2011), and some consider examination of the locomotor system is complicated and time consuming (Doherty *et al.*,1992). Examination of MSK system is frequently devoted to rheumatologist in the medical curriculum at undergraduate and postgraduate levels. This make many health professionals incompetent in this field. So patients with rheumatic (or neurological) complaints are referred to rheumatologists without an attempt to assess the underlying source of the symptoms or signs, in spite of the fact that rheumatology is a medical discipline. The teaching of MSK examination is relegated to the orthopedic surgeon. Unfortunately, the surgeon is mainly concerned about ascertaining whether there is any need for surgical intervention, either immediately or in the future. As a result, the focus of their assessment is directly related to determining the state of bone and cartilage, i.e. damage to the joint. The rheumatologist, on the other hand, is concerned with localizing the exact source of the pain in an effort to provide appropriate relief and prevent damage to the joint. The rheumatological evaluation is directed at determining whether the pain is being referred from another site, or arising locally from the inert structures (joint itself "bone and cartilage") or the contractile and related structures (extra-articular as ligaments, tendons, entheses, bursa, capsule, etc.) (Kalla, 2011).

So musculoskeletal conditions are common, but are often not identified if the person presents with other health problems (Woolf and Akesson,2008). A practical method is therefore required to alert medical practitioners to musculoskeletal problems. Such a method should be quick and easy to perform, and should reliably identify the abnormalities. Such a loco motor screen has been suggested by Doherty and has been given the acronym, GALS, which stands for Gait, Arms, Legs, and Spine (Plant *et al*.,1993). It is a simple screening assessment that has been developed to enable the identification and documentation of any musculoskeletal problem, which all doctors should be able to undertake. It is sensitive at identifying abnormalities of the musculoskeletal system. Any such problems will then need to be fully assessed Woolf and Akesson, 2008). The GALS screen has since been endorsed by the British Society for Rheumatology, and put forward for use in undergraduate teaching (Plant *et al*., 1993). The ability to question and examine a patient is a fundamental competency on which further education and training can be built. Reviews suggest that compared with other body systems locomotor history and examination skills are poorly learnt, resulting in inadequate recognition and assessment of locomotor disease and disability by junior doctors (Doherty *et al*., 1992).

GALS Efficiency and The Need For Modification

- GALS was adapted as a 'minimal' rheumatological screen that was shown to be sensitive in detecting locomotor abnormality (Doherty *et al*., 1992 ;Beattie *et al*.,2008).
- GALS has been used as part of core teaching in UK medical schools since1992, is widely accepted by the UK teachers in rheumatology, and effectively improves musculoskeletal clinical competence among junior doctors assessing adults (lillicrap *et al*., 2003; Fox *et al*., 2000).
- It may be useful as a diagnostic tool for the identification of musculoskeletal abnormalities and possible subsequent early intervention but, it cannot be considered a substitute for a more detailed locomotor exam (Beattie *et al*., 2008).
- Its ability to reflect disability has not been tested and proven (Plant *et al*, 1993).
- Adult GALS is not adequate, in its original form, as a musculoskeletal screening tool for use in school-age children. The majority of the abnormalities that were missed were at the foot and ankle and TMJ, which are not specifically tested in the original description of adult GALS (Foster *et al*., 2006).

- The examination is proven to be both valid and reliable when conducted by specialists in rheumatology, but, its effectiveness in the primary care setting has not yet been determined (Beattie *et al*.,2008).
- Since GALS is a minimal screening examination, it should be used even in patient without musculoskeletal symptoms. Previous studies did not test the sensitivity of GALS examination in these asymptomatic patients.
- In spite of near 20 years' experience in GALS, till now it is generally accepted mainly in the UK centers where it is taught in the 3 rd year of all medical schools. The reasons behind this delay is adopting GALS exam in various countries are not clear. However, any standardized test need to satisfy users concepts before being widely accepted. For lumber spine movement, for examples, the GALS uses only lumber movements and inspection of the lower limbs. To the authors knowledge there is no evidence that normal lumber movement exclude mild motor weakness or leg pain of root origin.

The aims of this study are

1. To study the ability of the GALS examination to detect abnormalities in patients without musculoskeletal symptoms.
2. To study whether particular modifications in the GALS can improve the sensitivity.

Review of Literature

Anatomy and physiology of the locomotor system: The locomotor system, like other body systems, can be defined anatomically and assessed functionally. Lower extremities support the weight of the body and allow ambulation. They require proper alignment and stability. Upper extremities reach, grasp, and hold, thereby allowing self-care, feeding, and work. They require mobility and strength. Diseases and disorders of the musculoskeletal system disturb anatomy and interfere with function (Paget *et al*., 2006). Musculoskeletal medicine requires more grounding in basic anatomy than many other disciplines (Monrad *et al*., 2011) because it involves many different anatomical structures (Doherty *et al*.; 1992) and it involves all body systems (Doherty and Dawes, 1992). The clinician must possess a thorough knowledge of the different issues requested in evaluating a musculoskeletal problem. The musculoskeletal system is derived embryologically from the mesenchyme and is composed of soft and hard connective tissues. These tissues have evolved to serve two basic functions: structural integrity and stable mobility (Gross *et al*., 2009). The basic functional unit of the musculoskeletal system is the joint which is the sites of articulation between one bone (or cartilage) and another (Swartz, 1998). The normal joint is a specialized, integrated structure consisting of multiple connective tissue elements, including muscles, tendons, ligaments, synovium and capsule, cartilage, and bone, organized in a manner that permits stability and movement of the human skeleton. The joint structures are positioned to distribute normal mechanical stresses optimally and are organized for low-friction load bearing. Deviations from normal structure and physiology of joint tissues have been implicated in the pathogenesis of various forms of arthritis (Goldring and Goldring, 2008).

Types of Joints

Joints are generally of three types:

- Fibrous joints (e.g., skull-type sutures) minimal movement.
- Cartilaginous and fibro cartilaginous joints (e.g., diskovertebral joints) limited movement
- synovial joints (e.g., most limb joints). Large movement which include six types:
- Hinge joint (elbow joint).
- Pivot joint (proximal radioulnar joint).
- Condyloid joint (wrist joint).
- Saddle joint (carpometacarpal joint of thumb).
- Ball and socket joint (hip& shoulder joint).
- Plane joint (patello femoral joint). (Lawry,2006; Swartz,1998).

Synovial joints permit a wide range of movement. Fibrous joints have a simpler structure than synovial joints and are less susceptible to disease and injury, the bones are connected by dense fibrous tissue and only a limited range of movement is permitted. In a synovial joint, the bone ends are covered by hyaline cartilage and the whole structure is enclosed in a capsule. The capsule is lined with synovium a specialized tissue responsible for lubricating the joint and nourishing the articular cartilage, which has no blood supply of its own. Synovium produces synovial fluid by a combination of ultra-filteration of plasma and active secretion of large molecules (e.g. hyaluronan). Normal synovial fluid is highly viscous because of entanglement of these molecules, whereas inflammatory synovial fluid has allow viscosity because the enzymes and free radicals associated with inflammation break them down (Dacre & Worrall, 2006).

The six basic function types of the joint motion are as following:

- Flexion &extension.
- Dorsiflexion& planter flexion.
- Adduction &abduction.
- Inversion &eversion.
- Internal& external rotation.
- Pronation &supination. (Swartz,1998).

Musculoskeletal Disorders

The disorders affecting MSK could be from:

- Systemic disorders such as rheumatoid arthritis, systemic lupus erythematosus or polymyositis.
- Localized joint disorders such as OA, tennis elbow, traumatic & other.
- Localized periarticular disorders such as carpal tunnel, tennis elbow& other.
- Manifistation or complication of other disorders like bowel disorders, cardiac disorders, malignancies, respiratory disorders & others.

Symptoms Of Musculoskeletal Problems

General (nonarticular) symptoms

- Fatigue and malaise.
- fever.
- weight loss.
- reduced appetite.

- psychological & Sleep disturbance.
- skin change, hair loss, nail change.
- eye pain, irritation & visual disturbance.
- bowel habit change.
- Symptoms of other systemic disease as CNS, CVS & RS.

Specific (articular) symptoms:

- Pain.
- Swelling.
- Stiffness.
- Deformity.
- Weakness.
- Instability.
- Loss of function.

The Impact of Musculoskeletal Disorders

Musculoskeletal (MSK) complaints are the most common problems seen by most general practitioners (GPs) (Rasker,1995; Doherty and Dawes,1992). Surveys of the workload of GPs have shown that between 10% and 25% of all consultations are for disorders of the musculoskeletal system (Oswald *et al*.,2011; Chileds *et al*.,2005; Rasker,1995), making it one of the most common reasons for consulting a physician (Humphreys *et al*., 2007). They are a source of significant health care expenditure and morbidity (Oswald *et al*., 2011). MSK disorders are the single most important factor influencing disability in later life (Doherty and Dawes,1992). The Office for National Statistics in the United Kingdom (UK) in 2003 found arthritis to be responsible for over five hundred thousand Disability Living Allowance (DLA) claims, this is far greater than the three hundred and thirty thousand claims for mental health illnesses (Sirisena *et al.,*2011). MSK conditions are the most common cause of severe long term pain and physical disability, they significantly affect the psychosocial status of affected people as well as their families and careers (Woolf & Akesson,2001). Although most patients will recover without treatment, some will develop persistent or progressive disease including systemic diseases (Rasker, 1995). MSK conditions are a diverse group with regard to pathophysiology but are linked anatomically and by their association with pain and impaired physical function. They encompass a spectrum of conditions, from those of acute onset and short duration to lifelong disorders, including osteoarthritis, rheumatoid arthritis, osteoporosis, and low back pain (Woolf & Akesson, 2001). Of those complaints, back and spine conditions are the most prevalent (Humphreys *et al*., 2007). The prevalence of many of these conditions increases markedly with age, and many are affected by lifestyle factors, such as obesity and lack of physical activity, the increasing number of older people and the changes in lifestyle throughout the world mean that the burden on people and society will increase dramatically (Woolf & Akesson, 2001). There is ample documentation of the current burden of musculoskeletal disease in the United States, in 2005 the two most common causes of disability were arthritis and spine problems. According to the 2008 National Health Interview Survey, an estimated one hundred ten million adults (approximately 50% of the adult population) reported having a disabling musculoskeletal condition, the sum of the direct expenditures in health care costs and the indirect expenditure in lost wages for persons with a musculoskeletal disease diagnosis has been estimated in 2004 in the US to be 849 billion dollars (Monrad *et al*., 2011).

Clinical Skills In Evaluating Joint Disorders: Over the next few decades, the number of MSK complaints is expected to rise. Despite the high prevalence and expected increase of MSK complaints, serious concerns have been raised about the education and training of medical doctors related to their knowledge and skills in MSK medicine (Humphreys *et al*; 2007). MSK physical examination (PE) is often neglected in clinical practice, there has been a decline in enrolment in MSK related specialties and a perceived low confidence and competence level in evaluating MSK condition, this issue resulted in a shortage of faculty prepared to teach this subject at all levels of medical education under-graduate and post-graduate (Oswald *et al*., 2011). This problem has long been recognized but has received increased attention over the past decade, and many countries have adopted different approaches to addressing this inadequacy within the medical school curriculum. As In the United States, one of the first unified attempts at undergraduate musculoskeletal curriculum reform started with the establishment of the National Bone and Joint Decade (USBJD) 2000–2010 (Monrad *et al*., 2011). History and clinical examination are key to diagnosis and prognosis in rheumatic disorders, With a competent clinical evaluation one can often eliminate the need for additional costly and/or time consuming investigations. In addition diagnosis mainly by purely careful and competent clinical examination is a highly gratifying activity for the medical doctor (Brühlmann and Michel, 2006). The Causes Deficiencies of in clinical Musculoskeletal Examination Skills has been summarized by Almoallim and Gelidan (2012) and others, these include:

- Vague training of MSK disorders in undergraduate programme.
- Examination of the MSK system is often regarded to be complex in comparison with other organ systems.
- Underestimation of the prevalence of MSK conditions and their impact on individuals and society.
- MSK disorders are not considered to be main competencies of medical graduates because they are not life threatening conditions.
- The lack of standardized approach to the clinical assessment of MSK problems, whether pertaining to primary care, rheumatology or orthopedics. Such standardize approach would present a competency benchmark.
- Lack of proper standard teaching in MSK disorders results in the low competence in MSK examination skills.
- Lack of summative evaluation of MSK examination skills contributes to low level of competency among medical graduates.
- The disparity in the approach to examination between rheumatologists and orthopaedic surgeons mostly lead to poor performances in MSK examinations.
- The lack of appropriate teaching and evaluation in MSK disorders, clinical teachers are not usually skilled in MSK examinations and thus bone and joint diseases are not screened.

The Basic Of Physical Examination Of The MSK System:
The locomotor system is complex and difficult to examine because it involves many different anatomical structures

(Doherty *et al*., 1992; Dacre & Worrall, 2006), and frequently neglected in examination (Plant *et al*.,1993). Many doctors, whether qualified in primary or secondary care or residents do not have adequate training and consequently lack the competency, skills and confidence to manage musculoskeletal disorders in their daily practice, they may not recognize the disorder or are unware of what can be achieved by appropriate care. The Competence in clinical examination gives confidence (Akesson *et al*.,2003; Myers *et al*., 2004). The MSK system examination should be an integral part to the holistic clinical assessment. It is particularly important as complaints arising from MSK conditions remain a significant cause of pain, disability, unemployment and dependence on state support while also impacting upon other non-MSK related medical conditions (Sirisena *et al.,* 2011). Recommendations for taking a medical history and performing a clinical examination relevant to a musculoskeletal problem are based on clinical experience acquired during under-graduates and post-graduates teaching of rheumatology (Woolf and Akesson,2008).The performance of a competent musculoskeletal assessment including history taking and examination, with an understanding of the age-dependent variation of normal joint appearance, may be the only way to detect important joint abnormalities, and facilitate diagnosis and referral to specialist teams (Myers *et al*.,2004). The clinician must be able to determine whether the patient's pathology is of musculoskeletal origin. The examination process must be performed in a specific and logical order, this order will remain the same regardless of whether the clinician is examining the shoulder joint or the spine. It is important for the examiner to develop the habit of utilizing a set sequence in order to be as organized and efficient as possible and to avoid inadvertently omitting in formation (Gross *et al*., 2009).

There are four essential steps in the examination of every patient joints:

- Inspection (look).
- Palpation (feel).
- Joint movement (move).
- The assessment of supporting structures and special testing. (Lawry,2006; Miller,1990).

Look for alignment, swelling, range, deformity, muscle wasting and skin changes, at rest and during movement.

Feel usually for the temperature of the overlying skin, tenderness at joint margin, swelling (whether fluid, soft tissue or bony) & crepitus during joint movement. Any deformity should include with palpation.

Move actively, then passively and against resistance to detected any abnormality. During movement Look for pain, range, stability and crepitus.

Special tests might be necessary. There is a range of special tests to try to further characterize the problem, (Woolf and Åkesson, 2008). Do not worry if you cannot remember the range of movement of all the joints. If the problem is unilateral, you can compare the abnormal side with the normal side; if it is bilateral, compare it with your own joints (Dacre & Worrall, 2006).

The GALS: MSK complaints are among the most common problems in clinical medicine. A full examination is time-consuming and seldom necessary (Dacre & Worrall, 2006). It is therefore important that all physicians are able to conduct a basic screening evaluation that identifies the presence of pathology or dysfunction of musculoskeletal structures (Robinson and El-Gabalawy,2008), followed by a more detailed assessment of the affected structures, with additional examination of other systems if indicated (Dacre & Worrall,2006). Over the past two decades, rheumatologists from around the world have not only championed the musculoskeletal system examination but also modified the undergraduate teaching curriculum. This has led to the development and adoption of the gait, arms, legs and spine (GALS) screening along with regional examination techniques (Sirisena *et al*., 2011). In 1992, Doherty *et al.,* developed a musculoskeletal screening assessment termed GALS (gait, arms, legs and spine), which is selective clinical process to detect important locomotor abnormalities and functional disability. GALS based on a tested 'minimal' history and examination system. The GALS provides a useful introduction to examination of the locomotor system, and includes objective observation of functional movements relevant to activities of daily living (Doherty *et al*., 1992). The GALS is a rapid, validated screening examination of the musculoskeletal system with high sensitivity and specificity for the detection of joint abnormalities, and is now widely taught throughout UK medical schools (Lee,2010; Coady *et al*.,2004). The teaching of this screening examination appears to have made a difference. A more detailed regional examination once an abnormality has been identified on the initial history and examination (Coady *et al*., 2004). The GALS screening examination was initially used in adult patient (Myers *et al*.,2004; Doherty *et al*.,1992). There are several modified version of the GALS screen used throughout the world, it is important to remember that GALS is not meant to be a complete diagnostic examination but a brief screening examination for significant abnormality of the MSK system. (Goh *et al*., 2004).

Definition of GALS

The GALS locomotor system screen is a quick, easy to perform, sensitive indicator of locomotor abnormality and has been shown to be a reliable and valid measure of functional ability, it can be quickly learnt by undergraduates and postgraduates (Fox *et al*., 2000). It is a brief screening examination, which takes 1–2 minutes, has been devised for use in routine clinical assessment. This has been shown to be highly sensitive in detecting significant abnormalities of the musculoskeletal system. It involves inspecting carefully for joint swelling and abnormal posture, as well as assessing the joints for normal movement. The sequence in which these four elements are assessed can be varied – in practice, standing sitting & supine position are all needed in GALS examination. An assessment of the MSK system should always take place in the routine assessment of patients. Screening questions for musculoskeletal disorders should be incorporated into the routine systemic enquiry of every patient. The main symptom arising from disorders of the musculoskeletal system are pain, stiffness, swelling, and associated functional problems.

The screening questions directly address these aspects:

- 'Do you have any pain or stiffness in your muscles, joints or back?'.
- 'Can you dress yourself completely without any difficulty?'.

- 'Can you walk up and down stairs without any difficulty?'.

A patient who has no pain or stiffness, and no difficulty with dressing or with climbing stairs is unlikely to be suffering from any significant musculoskeletal disorder. If the patient does have pain or stiffness, or difficulty with either of these activities, then a more detailed history is needed (Doherty *et al*., 1992).

Pain: Pain is the most prominent symptom in most people with arthritis, and is the most important determinant of disability in patients with osteoarthritis. Moreover, the pain and physical disability brought about by musculoskeletal conditions affect social functioning and mental health, further diminishing the patient's quality of life. (Woolf & Akesson, 2001). As with all pains, it is important to record the site, character, radiation, and aggravating and relieving factors. Patients may localize their pain accurately to the affected joint, or they may feel it radiating from the joint or even into an adjacent joint. In the shoulder, for example, pain from the acromioclavicular (AC) joint is usually felt in that joint, whereas pain from the glenohumeral joint or rotator cuff is usually felt in the upper arm. Pain due to irritation of a nerve will be felt in the distribution of the nerve as in sciatica, for example. The pain may localize to a structure near rather than in the joint for example, the pain from tennis elbow will usually be felt on the outside of the elbow joint. The character of the pain is sometimes helpful, pain due to pressure on nerves often has a combination of numbness and tingling associated with it. However, the character of musculoskeletal pain can be very variable and is not always helpful in making a diagnosis (Doherty *et al*., 1992). Pain of a non-inflammatory origin is more directly related to use the more you do the worse it gets. Pain caused by inflammation is often present at rest as well as on use, and tends to vary from day to day and from week to week in an unpredictable fashion. It flares up and then it settles down. Severe bone pain is often unremitting and persists through the night, disturbing the patient's sleep (Arthritis Research Campaign, 2005).

Stiffness: stiffness means difficulty in moving the joint after period of inactivity especially in early morning. In general, inflammatory arthritis is associated with prolonged morning stiffness which is generalized and may last for several hours. The duration of the morning stiffness is a rough guide to the activity of the inflammation. Commonly, patients with inflammatory disease will also describe worse stiffness in the evening as part of a diurnal variation. With inflammatory diseases such as rheumatoid arthritis (RA), where joint destruction occurs over a prolonged period, the inflammatory component may eventually become less active and the patient may then only complain of brief stiffness in the morning. In contrast, osteoarthritis (OA) causes localized stiffness in the affected joints which is short-lasting (less than 30 minutes) but recurs after periods of inactivity. It is sometimes difficult for patients to distinguish between pain and stiffness, so your questions will need to be specific. It may help to remind the patient that stiffness means difficulty in moving the joint (Arthritis Research Campaign, 2005).

Joint swelling: A history of joint swelling, especially if it is intermittent, is normally a good indication of an inflammatory disease process but there are exceptions. Nodal osteoarthritis, for example, causes bony, hard and non-tender swelling in the proximal inter phalangeal (PIP) and distal inter phalangeal (DIP) joints of the fingers. Swelling of the knee is also less suggestive of inflammatory disease as it can also occur with trauma and in OA. Ankle swelling is a common complaint, but this is more commonly due to edema than to swelling of the joint (Arthritis Research Campaign, 2005).

Subjects, Materials and Methods: For ethical consideration, this study was approved by the related committees in the College of Medicine. The study has been conducted at the rheumatology clinic of Ibn-Sina teaching hospital, Mosul, Iraq. The patients collection was completed on June 2011.

Study Design: Clinical case-series collection.

Subjects: The study was conducted on one hundred adult males after taking their consent to participate in this study, their ages were between 30 - 50 years and they were not suffering from MSK complain after asking them the three questions which are the following:

- 'Do you have any pain or stiffness in your muscles, joints or back?'.
- 'Can you dress yourself completely without any difficulty?'.
- 'Can you walk up and down stairs without any difficulty?'.
- These three questions are part of GALS assessment (Doherty *et al.,* 1992).

Proposed Equipment

- Tape measure.
- Examination couch.
- Plastic goniometer.
- Electronic Stopwatch

Methods: All the data were obtained from the patients by the investigator himself during interviews with them, including.

GALS over view: A brief screening examination, which takes 2-3 minutes, has been devised for use in routine clinical assessment. This has been shown to be highly sensitive in detecting significant abnormalities of the musculoskeletal system. It involves inspecting carefully for joint swelling and abnormal posture, as well as assessing the joints for normal movement. The sequence in which these four elements are assessed can be varied in practice, it is usually more convenient to complete the elements for which the patient is weight bearing before asking the patient to climb onto the couch (the order of examination is unimportant and the usual most convenient examination sequence is gait, spine, arms, legs, with overlap between these components) (Doherty *et al.,*1992).

Gait

- Ask the patient to walk a few steps, turn and walk back. Observe the patient's gait for symmetry, smoothness and the ability to turn quickly.
- With the patient standing in the anatomical position, observe from behind, from the side, and from in front for: bulk and symmetry of the shoulder, gluteal, quadriceps and calf muscles; limb alignment; alignment

of the spine; equal level of the iliac crests; ability to fully extend the elbows and knees; popliteal swelling; abnormalities in the feet such as an excessively high or low arch profile, clawing/ retraction of the toes and/or presence of hallux valgus.

Arms

- Ask the patient to put his hands behind their head. Assess shoulder abduction and external rotation, and elbow flexion (these are often the first movements to be affected by shoulder problems).
- With the patient's hands held out, palms down, fingers outstretched, observe the backs of the hands for joint swelling and deformity.
- Ask the patient to turn their hands over. Look at the palms for muscle bulk and for any visual signs of abnormality.
- Ask the patient to make a fist. Visually assess grip power, hand and wrist function, and range of movement in the fingers.
- Ask the patient to squeeze your fingers. Assess grip strength.
- Ask the patient to bring each finger in turn to meet the thumb. Assess fine precision pinch (this is important functionally).
- Gently squeeze across the metacarpophalangeal (MCP) joints to check for tenderness suggesting inflammatory joint disease.

Legs

- With the patient lying on the couch, assess full flexion and extension of both knees, feeling for crepitus.
- With the hip and knee flexed to 90º, holding the knee and ankle to guide the movement, assess internal rotation of each hip in flexion (this is often the first movement affected by hip problems).
- Perform a patellar tap to check for a knee effusion. Slide your hand down the thigh, pushing down over the supra patellar pouch so that any effusion is forced behind the patella. When you reach the upper pole of the patella, keep your hand there and maintain pressure. Use two or three fingers of the other hand to push the patella down gently, Does it bounce and 'tap'? This indicates the presence of an effusion.
- From the end of the couch, inspect the feet for swelling, deformity, and callosities on the soles.
- Squeeze across the metatarsophalangeal (MTP) joints to check for tenderness suggesting inflammatory joint disease. (Be sure to watch the patient's face for signs of discomfort).

Spine

- With the patient standing, inspect the spine from behind for evidence of scoliosis, and from the side for abnormal lordosis or kyphosis.
- Ask the patient to tilt their head to each side, bringing the ear towards the shoulder. Assessing lateral flexion of the neck (it is considered sensitive in the detection of early neck problems).
- Ask the patient to bend to touch their toes. This movement is important functionally (for dressing) but can be achieved relying on good hip flexion, so it is important to palpate for normal movement of the vertebrae. Assess lumbar spine flexion by placing two or three fingers on the lumbar vertebrae. Your fingers should move apart on flexion and back together on extension.

The modified GALS (M-GALS):-The modified GALS includes most the components of the standard GALS with several alteration or additions as:...

- Temporo- mandibular joint is assessed by asking the patient to open his mouth and to insert three of his own fingers in to the mouth.
- Neck movement is extension instead of lateral bending.
- Shoulder movement is internal rotation instead of external rotation.
- Wrist assessment include flexion and extension.
- MCP pain is induced by extension in addition to squeezing test.
- Heel and toe walking were added to original GALS.

Recording the findings from the screening examination (GALS) and modified GALS: It is important to record both positive and negative findings in the notes. The presence or absence of changes in appearance or movement in the gait, arms, legs or spine should be noted in a grid. If there are abnormalities, these should be recorded with a cross, and a note should be made describing the abnormalities.

a) **a normal result**

	APPEARANCE	MOVEMENT
GAIT	✓	
ARM	✓	✓
LEG	✓	✓
SPINE	✓	✓

b) abnormal result. for example; patient with wrist and knee swelling and associated loss of movement

	APPEARANCE	MOVEMENT
GAIT	✓	
ARM	X	X
LEG	X	X
SPINE	✓	✓
Swelling over dorsum of both wrist & knee effusion		

Internists interview about GALS: Pilot screening of locomotor examination competence of the postgraduate medical trainee in Ibn Senna teaching hospital. The author directly interviewed 25 medical board students in Ibn Senna teaching hospital, to have their answers about:

a. What is GALS ? if the candidate knows what the acronyms mean, the next question is :
b. What are the major contents of the GALS ? If the answer is favourable ; the next question is :
c. Do you practice GALS on your patients

Statistical analysis: The data were delivered into SPSS program (version 18); and the following tests were done:

1. Standard statistical methods were used to determine the descriptive data, mean and standard deviation.

2. Statistical difference between data was done by tow-proportion test.
3. Correlation by ranks was tested by Spearman's Coefficient of rank correlation.
4. *P*-value ≤ 0.05 was considered statistically significant.

RESULTS

One hundred adult males were studied as mentioned in details in the method. Table (4.1) shows the Demographic features of the patients.

Table 4.1. Demographic features of the patients

Age Group	30-39	63(63%)
	40-50	37(37%)
	Age :Mean(±SD)	38.66(±5.49)
Locality	Urban	89
	Rural	11

This table (4.2) demonstrate that GALS screening exam can detect abnormalities in 22% of asymptomatic patients of 30-50 years of age.

Table 4.2. Major finding in the GALS examination

CATEGORY	NORMAL	ABNORMAL
Gait	100 (100%)	0 (0%)
Arm appearance	99 (99%)	1 (1%)
Arm movement	91(91%)	9 (9%)
Leg appearance	98 (98%)	2 (2%)
Leg movement	97 (97%)	3 (3%)
Spine appearance	100 (100%)	0 (0%)
Spine movement	90 (90%)	10 (10%)
Total	78 (78%)	22 (22%)

This table (4.3) demonstrate that M-GALS screening exam can detect abnormalities in 27% of asymptomatic patients of 30-50 years of age.

Table 4.3. Major finding in the modified GALS examination

category	Normal	abnormal
Gait	90 (90%)	10 (10%)
Arm appearance	99 (99%)	1 (1%)
Arm movement	89 (89%)	11(11%)
Leg appearance	98 (98%)	2 (2%)
Leg movement	97 (97%)	3 (3%)
Spine appearance	100(100%)	0 (0%)
Spine movement	82 (82%)	18 (18%)
Total	73 (73%)	27 (27%)

This Table (4.4) demonstrate that the abnormalities in the GALS examination were in shoulder, cervical spine, lumber spine and knees.

Table 4.4. Findings analysis in the GALS examination

Category	Normal	abnormal
Gait	100(100%)	0 (0%)
Cervical	95 (95%)	5 (5%)
Shoulder	91 (91%)	9 (9%)
Elbow	100 (100%)	0 (0%)
Hand	100 (100%)	0 (0%)
Wrist	100 (100%)	0 (0%)
MCP Squeeze	100 (100%)	0 (0%)
IP Appearance	100 (100%)	0 (0%)
Fist	100 (100%)	0 (0%)
Fine Precision	100 (100%)	0 (0%)
Lumber	93 (93%)	7 (7%)
Hip	100 (100%)	0 (0%)
Knee	97 (97%)	3 (3%)
Feet	100 (100%)	0 (0%)
Ankle	100 (100%)	0 (0%)
MTP squeeze	100 (100%)	0 (0%)

This Table (4.5) demonstrate that the abnormalities in the M-GALS examination were in gait (heel & toe walking) shoulder, cervical spine, lumber spine and knees.

Table 4.5. Finding analysis in the modified GALS examination

Category	normal	abnormal
Gait	90 (90%)	10(10%)
TMJ	100(100%)	0 (0%)
Cervical extension	87 (87%)	13(13%)
Shoulder Int. rotation	89 (89%)	11(11%)
Elbow	100(100%)	0 (0%)
Hand	100(100%)	0 (0%)
Wrist	100(100%)	0 (0%)
MCP extension	100(100%)	0 (0%)
IP extension	100(100%)	0 (0%)
Fist	100(100%)	0 (0%)
Fine precision	100(100%)	0 (0%)
Lumber	93 (93%)	7 (7%)
Hip	100(100%)	0 (0%)
Knee	97 (97%)	3 (3%)
Feet	100(100%)	0 (0%)
Ankle	100(100%)	0 (0%)
MTP seq.	100(100%)	0 (0%)
Toe walking	97(97%)	3 (3%)
Heel walking	93(93%)	7 (7%)

Table (4.6) show that the M-GALS is significantly more sensitive than GALS in detecting abnormalities in gait and spine (cervical spine). The difference in GALS and M-GALS in detecting arm movement abnormalities did not reach statistical significance.

Table 4.6. Comparison between GALS and modified GALS in the major finding

CATEGORY	GALS ABNORMALITY	MGALS ABNORMALITY	P-VALUE
Gait	0 (0%)	10 (10%)	0.001*
Arm appearance	1 (1%)	1 (1%)	
Arm movement	9 (9%)	11(11%)	0.63
Leg appearance	2 (2%)	2 (2%)	
Leg movement	3 (3%)	3 (3%)	
Spine appearance	0 (0%)	0 (0%)	
Spine movement	10 (10%)	18 (18%)	0.1

* = Significant P-value according to two-proportions test (< 0.05).

Table (4.7) show that the abnormalities in gait between GALS and M-GALS were in only in toe walking & heel walking. the abnormalities in spine movements were different between GALS and M-GALS in the cervical spine only.

Table 4.7. Comparison between analytical data of GALS and modified GALS

Sites of abnormalities	Gals abnormalities	Modified gals abnormalities	P- value
Gait	0	10	0.001*
Tmj	0	0	
Cervical	5	13	0.04*
Shoulder	9	11	0.63
Elbow	0	0	
Wrist	0	0	
Wrist flexion	-	0	
Wristextension	-	0	
Hand	0	0	
Mcpextension	-	0	
Ip extension	-	0	
Lumber	7	7	
Hip	0	0	
Knee	3	3	
Ankle	0	0	
Foot	0	0	
Toe walking	-	3	
Heel walking	-	7	

* = Significant P-value according to two-proportions test (< 0.05).

Table (4.8) show a significant positive correlation between abnormalities in: cervical extension and shoulder internal rotation, lumber movement and heel walking, knee abnormalities and toe walking. Increasing age correlated positively with abnormalities in both cervical extension and shoulder internal rotation.

Table 4.8. Correlation between modified GALS components

Modified gals component		correlation
cervical extension	shoulder internal rotation	0.613*
Lumber	heel walking	0.696*
Knee	toe walking	0.660*
cervical extension	Increasing Age	0.503*
shoulder internal rotation	Increasing Age	0.387*

* = P-value < 0.05 according to Spearman's rank correlation coefficient.

Table (4.9) show a positive correlation between cervical lateral bending and shoulder external rotation. Increasing age correlated with abnormalities in both cervical lateral bending and shoulder external rotation.

Table 4.9. Correlation between GALS components

Gals Component		Correlation
cervical lateral	shoulder external rotation	0.241*
cervical lateral	Increasing Age	0.299*
shoulder external rotation	Increasing Age	0.336*

* = P-value < 0.05 according to Spearman's rank correlation coefficient.

The results of the pilot screen of the competence of our medical board students in performing locomotor screening examination.

Table 4.10. Internist interview

No. of survey internist	Knowing details of GALS %	Practicing GALS%
25	5 (20%)	0 (0%)

DISCUSSION

Gait, Arm, Leg, Spine (GALS) clinical examination has been introduced to be a routine initial musculoskeletal assessment of attending patients. It comprises three questions and a simple organized examination, taking about 2-3 minute to complete, these screening questions however have low sensitivity demonstrating that clinical history alone may be unhelpful as a musculoskeletal screening tool (Foster *et al*.,2006). Before the development of the GALS assessment tool, there was no recognized standard examination of the musculoskeletal system (Lee, 2010). Review of literatures provide limited information about any attempt to modify the GALS, except in children. This study was designed to compare between the previously reported GALS examination and a modified GALS, aiming at improving the examination in detecting abnormalities. To our knowledge this is the first study which describes GALS examination findings in patients without musculoskeletal symptoms. In 2003, Lillicrap *et al*., published a study assessing the state of musculoskeletal assessment among medical inpatients. The results demonstrated that relevant musculoskeletal history and signs were frequently missed by the staff (Lee, 2010). Competent performance of GALS will facilitate a consequent problem-orientated regional examination. In pediatrics it has been suggested that GALS be incorporated in routine assessment of all patient undergoing full clinical assessment, because significant musculoskeletal problems can manifest in diseases such as infection, cardiovascular diseases or inflammatory bowel disease and others. This strategy will raise awareness of musculoskeletal problems in inpatients and will facilitate appropriate management, thus optimizing patient care (Foster *et al*.,2006).

Patient's age was selected between 30-50 years to reduce the effect of aging on musculoskeletal examination. In the past years, several cross sectional studies on musculoskeletal complaints have reported a sharp increase in prevalence rates of these complaints with advancing age for both male and female workers. The biological changes related to the aging process, for example, degenerative changes of muscles, tendons, ligaments, and joints, are suggested to contribute to the pathogenesis of musculoskeletal disorders. Increasing age may increase the susceptibility of tissues to physical loads, this has also been suggested as a potential cause for the development of musculoskeletal disorders (Cassou *et al*.,2002 ; Butler *et al*.,2012). The GALS examination in our group (table 4.2) showed spine movement abnormalities in (10%), arm movement abnormalities in (9%), leg movement abnormalities (3%)and gait abnormality in no patient, whereas the modified GALS (table 4.3) showed abnormalities in the gait in (10%), arm movement in (11%), spine movement abnormalities in (18%), leg movement abnormalities in (3%), It is clear that the modified GALS detected more abnormalities in the gait and spine movement in addition to slight increase in detecting abnormalities in arm movement. The addition of toe and heel walking in the pediatric GALS was explained by the difficulty in heel walking in tendinitis, enthesitis or arthritis of the ankle/foot, and osteochondroses (e.g., Sever's disease). On the other hand difficulties in toe walking is expected in neuromuscular disease but has been reported as a presenting feature of arthritis (metatarsalgia) or local trauma of the foot (Foster *et al*.,2006). In adults, diseases that can affect toe and heel walking are common which make including them in adults GALS very reasonable, for example walking on heels can be difficult in L4-L5 disc prolapse which can affect ankle extensor (platzer, 2003), it can be painful in sciatic patients with a positive straight leg raise test (SLRT) (Boland and Adams 2000; Smith *et al*.,1993); ankle dorsiflexion is actually an augmentation test for the SLRT (AHCPR,2008), This may explain the finding in this study of a correlation between lumber spine abnormality and painful heel walking (AHCPR,2008).

Toe walking can be difficult in L5-S1disc prolapse which can weaken the ankle flexors (platzer, 2003). The big toe metatarsophalangeal (MTP) is a common site for arthritis and bursitis (Fields, 2006) which can impair toe walking. Tendinitis and enthesopathis can affect both toe and heel walking.Table (4.2) GALS examination in asymptomatic patients detected abnormalities in 22% of patients, while in table (4.3) in modified GALS abnormalities are detected in (27%) of asymptomatic patients; these finding emphasize the importance of physical examination in rheumatology. Actually the screening questions of GALS assessment have already been considered to be of low sensitivity (Foster *et al* ., 2006). The difference in total abnormalities in GALS and modified GALS did not reach statistical significance (p- value 0.4). However the difference between GALS and modified GALS were significant in the gait and cervical spine (p-value 0.001,0.04) respectively. "Arm" movement abnormalities in both GALS and modified GALS were only in the shoulder movements; however in GALS examination, external rotation

revealed abnormality in (9%) patients whereas in modified GALS internal rotation revealed abnormality in (11%) patients. only (7) patients shared abnormality in both external and internal rotation. This finding suggest that including both movements in shoulder examination should be considered. kalla, 2011; Carpenter *et al*.,1998 and Blasier *et al*.,1994 suggest that external rotation is more sensitive while Beardsley *et al.,*2010 suggest no difference in both internal and external rotation. The increased sensitivity of modified GALS in detecting cervical spine abnormality was apparently due to employing neck extension instead of lateral flexion. the (5) patients who had neck pain on lateral flexion in GALS examination were all present in the (13) patients who has painful extension in modified GALS. This finding suggest the neck extension is more sensitive and is not augmented by adding lateral flexion. Table (4.5) show gait abnormalities in 10 patients; 7 abnormalities in heel walking and 3 abnormalities in toe walking while in original GALS, toe and heel walking were not used. The correlations between various components of GALS and modified GALS are presented in table (4.8) and (4.9). The correlations are more significant in the modified GALS. The correlation between painful cervical extension and abnormal shoulder internal rotation may be explained by the significant association between cervical spine syndrome and shoulder limitations (Weh L and Ehlers K, 1989; Gorski, and Schwartz, 2003). The correlation between increasing age and both painful cervical extension and painful \limited shoulder internal rotation may be explained by the relationship between aging, degenerative joint disorders and the shoulder impingement syndrome (Cassou *et al*., 2002; Beattie *et al*.,2008; Butler *et al*., 2012).

The exact explanation of the correlation between knee abnormalities and difficulty in toe walking is not clear in this study. However, in a previous study it was found that knee abnormalities are significantly frequent in the sciatic limb compared with sound limb in patients with chronic unilateral sciatica (Al Kutobi and Al Omari, 2003). This study demonstrate that the majority of our postgraduate medical trainees have no clear idea about the GALS examination and all of them practice no any joint screening examination. This finding is consistent with previous studies. Sirisena *et al*., 2010 show that GALS screenings were performed for 4% of patients in the medical assessment unit, 7% of acute medical and 0% of acute surgical patients on admission. Interviews with junior doctors found that 10% of the doctors routinely screened for MSK conditions though 87% felt confident in taking MSK histories. Matzkin *et al.*, 2005 indicate that the majority (79%) of the study respondents including medical students, residents, and staff physicians failed the basic MSK cognitive examination. Goldenberg *et al.* 1985 reported that the majority of directors of residency programs thought that many basic skills and the training of residents in rheumatology was not equal to their training in cardiology and castroenterology (pasley *et al*., 2011). A number of authors have noted that the teaching of musculoskeletal medicine is currently inadequate. This was highlighted by a study from the University of Pennsylvania where 82% of medical school graduates failed to demonstrate basic competency in musculoskeletal medicine. Another study revealed that only 7% of students from Harvard medical school passed a musculoskeletal competency exam. Limited teaching time was identified as a problem at Canadian medical schools where, on average, only 2.3% of curriculum time was spent on musculoskeletal medicine. In the absence of adequate clinical skills in rheumatology for our medical colleges, joint and spine examination will remain containing too many secrets known only to the rheumatologist and probably the orthopedics.

Abbreviations

AC	Acromioclavicular
DIP	Distal inter phalengeal
GALS	Gait, Arms, Legs, and Spine
GPs	General practitioners
MCP	Metacarpophalangeal
MGALS	Modified Gait, Arms, Legs, and Spine
MSK	Musculoskeletal
MTP	Metatarsophalangeal
OA	Osteoarthritis
PIP	Proximal inter phalangeal
RA	Rheumatoid arthritis
SD	Standard deviation
SLR	Straight leg raising
TMJ	Temporo-Mandibular Joint
UK	United kingdom
US	United state

Conclusion and Recommendation

- Rapid screening musculoskeletal examination (GALS and MGALS) can detect abnormalities in up to 27% of asymptomatic persons (using screening questions). Medical teaching should therefor give particular concern to examination skills of the musculoskeletal system.
- The MGALS detected more abnormalities than the GALS examination, indicating that rapid screening evaluation needs further improvements.
- Musculoskeletal clinical evaluation is inadequate in many studies, including this study. Under- and post-graduate training programs should devote more time and concern to this field.

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