The research by Liu et al.1 addressed the possible sources of low back pain (LBP) and lower limb pain and the factors confounding a precise diagnosis. Patients with unremitting LBP are often treated with lumbar surgery. Post-surgical, recurrent LBP is termed failed back surgery syndrome (FBSS) and is associated with peripheral arterial occlusion disease (PAOD) and neuropathy. The cause of FBSS is complicated by lower limb symptoms. Perfusion insufficiency and neurogenic claudication may occur simultaneously and produce LBP and lower limb pain. Degenerative changes in lower limb musculature are also possible in the absence of vascular occlusion or neuropathic claudication.

The selection of the Liu et al.1 article was guided by the following diagnostic PICO question. In patients with post-lumbar spine surgery, will vascular occlusion, as compared to neuropathic claudication, present as low back and lower extremity pain? Liu et al.1 aimed to demonstrate the similitude of vascular and neuropathic symptoms in patients with FBSS.

Liu et al.1 conducted a non-experimental, cross-sectional, diagnostic study design. Demographic data was collected, physical examinations were administered, and multiple diagnostic tests were performed on the subjects. Computed tomography (CT) was used to assess neural structures, magnetic resonance imaging (MRI) examined the lumbar spine, and the superficial femoral artery was studied via lower limb angiography. Electromyography (EMG) and nerve conduction velocity tests were performed during a graded exercise test on a bicycle ergometer. Muscle perfusion was tested post-exercise. Subjects were injected with Thallium-201 and the myocardium and lower limbs were scanned using scintigraphy and single-photon emission computed tomography (SPECT) imaging was administered.

The researcher’s implied hypothesis was diagnostic testing would clarify the underlying cause of LBP and lower limb pain in patients with FBSS. Successful diagnosis was suspected to be determined through diagnostic tests with high measurement validity. Test results were expected to elucidate if pain was from a vasculogenic or neurogenic source.

Subjects who underwent spinal surgery within the past 5 years were included into the study (n=1076). Case presentations within the convenience sample varied. The independent variables (IVs) were the physical examination and diagnostic tests performed, including: CT, MRI, myocardial and lower limb scintigraphy, SPECT, angiography,

EMG and nerve conduction velocity. The dependent variables (DVs) were muscular perfusion insufficiency and/or neurogenic claudication. Liu et al\textsuperscript{1} identified tests that predicted the likelihood of the DVs in patients with FBSS.

Demographic data showed the majority of the subjects were smokers (n=17) and had comorbidities, such as coronary artery disease, hyperlipidemia, renal insufficiency and hypertension. Subjects diagnosed with PAOD had ischemic pain, vascular claudication and symptoms such as LBP. LBP occurred in the presence and in the absence of radiating root pain and sensory disturbance. Neuropathic and vascular features varied throughout the sample. Most subjects exhibited abnormal results in the lower extremity scintigraphy scanning. Muscle perfusion, between the two lower extremities, showed an average difference of approximately 14%. Aberrant neuropathic pain patterns and lower extremity muscle wasting were found during the long-distance walking portion of the physical examination.

Radiological findings and patient reports alone do not provide adequate evidence for spinal surgery. Symptoms insinuating a spinal disorder and/or neuropathy can not be distinguished from ischemic pain without a complete assessment of both neuronal lesions and muscle perfusion. Liu et al\(^1\) highlighted the need for health professionals to become more attentive to limb pain from lower perfusion syndrome.

Liu et al\(^1\) failed to critique their research; however, limitations were apparent. Instrumentation was a threat to research validity. The researchers used gold standards of instrumentation to assess the DVs, yet gold standards are not verifiable considering there is no reference against which to compare.\(^2\) By not adequately defining exclusion criteria, the ability to determine how well the diagnostic tests differentiated the stages of FBSS was limited. Subject-specific selection criteria was defined broadly despite evidence of decreased success rates with secondary and tertiary surgeries.

Demographic data in patients with FBSS was analogous to the patient in the case study. Identical data included: depression, economic problems, comorbidities, smoking, surgical area and age. The patient presented with both neuropathic and vascular features and the research provided insight into how to differentially diagnose subjects with this symptom similarity. The implication of the research by Liu et al\(^1\) effects how the patient’s case would be managed. This research helped to integrate the best available evidence with clinical decision-making and suggested best approaches to diagnosis.

Identifying the source of pain in patients with FBSS is challenging. Conservative therapy may not be successful in patients with FBSS because the exact cause of FBSS is ambiguous. Poor prognoses in patients with FBSS indicate better approaches for diagnosis are warranted.