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Understanding wound pain: the physiology of nociceptors and inflammation

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Questions	Answers by Tami Siewinski
How does nociceptive transmission differ in chronic pain?	From the very first nociceptor firing in acute wounds, the nociceptor pathways change. The pathways taken to the brain change. Peripherally, nociceptors are changed through inflammatory mediators or repeated stimulation to fire at a lower intensity of stimuli that would not normally be painful. The change in pathways results in a change in signalling and a change in sensation to either hyperalgesia, or the opposite. This occurs when the inflammatory or acute healing pathway is either altered or stalled.
How long can analgesia be prescribed and how strong should analgesics be?	The choice and duration of analgesics is dependent upon the stimulus causing the pain. Is it inflammation? Is it bioburden? Is it neuropathic firing? All of these examples would use different analgesic methodologies. So, it's really difficult to answer your question - great one that it is! The common clinical goal with pain management is to control the patients' pain, as long as the patient is experiencing pain, through the use of analgesic methods that are safe, and do no harm to the patient. Every classification of pharmacologic analgesics has their own list of side effects and precautions. Most clinicians will start with symptom management analgesics and change depending on the patient's physiological response.
What happens to wound pain when infection occurs?	When a wound is infected, or overcome by invading pathogens, the body elicits an exaggerated inflammatory response so the cytokines and inflammatory mediators can go in and start to fight the infection. The huge influx of inflammatory cells creates an increase in interstitial pressure and oedema and this results in decreased perfusion. Now, the nociceptors are firing to signal the release of inflammatory cells, and the mechanical stimulation from oedema, ischemia and the release of intracellular components from the dying cells all create a perfect storm of nociceptor fiber stimulation resulting in pain, heat and oedema.

Question	Answer
Would promoting an anti-inflammatory diet help reduce the activation of inflammatory mediators and neurotransmission of wound pain? On a personal level, I have found this greatly helpful for neurological head pain of unidentified aetiology... a combination of Turmeric, ginger, chili, garlic and Cod liver oil.	There is MUCH anecdotal evidence that every single thing you mentioned may help with control of generalized inflammation. But remember, generalized inflammation is not wound inflammation. The differences are in the intracellular release of active components specific to the area and mechanisms of damage. Having said that, I'm a firm believer in diet modification to assist with generalized inflammation. Also, remember, any patient with a chronic wound should always have a dietary consult!!
Why doesn't the body desensitise chronic signalling?	Sometimes the body DOES desensitize chronic pain, but not in the way you think. The repeated stimulation of nociceptor fibres (A-Beta and C especially) creates the alterations in the signalling pathways. These can go several different ways. They can cause hyperalgesia or more intense pain with each stimulation. They can cause neuropathies which can create alterations in the signalling pathways resulting in absent, dull or muted pain. These changes are not good. They can expose the patient to more injuries that may be left unnoticed.
Can you explain phantom pain?	Phantom pain is a type of neurogenic pain. What we currently know is that an amputation sections nerves, and that nerve injury is followed by a series of changes that occur first in the peripheral nociceptors and then cascade into structural and chemical changes within the central nervous system.
What medication/treatment is best to treat wound pain?	Unfortunately, I can't answer your question because the appropriate treatments are dependent on too many variables including type of pain, depth of pain, quality of pain, area of pain (bone, muscle, tendon, soft tissue, etc…). What I CAN tell you is there is no "one size fits all" treatment for wound pain.
Why do some neuropathic patients feel wound pain when infected but not otherwise?	Wound infections result in multiple levels and types of nociceptor stimulation. So, for patients who normally don't feel pain, the underlying inflammatory processes from infection are creating a chemical firing environment that is not usual, thus they can feel some of the results of nociceptor stimulation in different pathways.
What pain responses do patients have from a surgical site?	Surgical site pain involves alpha-delta nociceptor fibre stimulation and release of neurotransmitters which begin the chemical signalling cascade for haemostasis and inflammation.
What would/could you use as an alternative to popular anti-inflammatory drugs such as ibuprofen and aspirin? Lots of people now have allergies to these?	The most commonly used alternative therapeutics for well-known anti-inflammatory drugs are cool, wet topical compresses, topical aloe vera plant extracts, rest and elevation whenever possible.

Question	Answer
A patient has told me about turmeric helping with pain. Do you know of any research which supports this?	Curcuma longa (turmeric) has been used as a medicinal herb for treatment of inflammation, pain, wound healing, and digestive disorders, FOREVER! Some preclinical research found that turmeric and its bioactive curcuminoid polyphenols can affect a variety of chronic conditions. Here are two of my favourite articles that discuss the benefits of turmeric. Nelson K, Dahlin J, Bisson J, et al. The essential medicinal chemistry of curcumin. J Med Chem. 2017;60:1620–1637. Eke-Okoro U, Raffa R, Pergolizzi J, et al. Curcumin in turmeric: basic and clinical evidence for a potential role in analgesia. J Clin Pharm Ther. 2018;43:460–466.
What medication would be best to give to palliative patients to relive pain?	Unfortunately, I can't answer your question because the appropriate treatments are dependent on too many variables including type of pain, depth of pain, quality of pain, area of pain (bone, muscle, tendon, soft tissue, etc…), respiratory status, etc. Just remember, when you are dealing with palliative pain control, there is no "one size fits all" treatment.
I'm a vascular surgery nurse 1 year qualified and still learning. How do pain signals affect the vascular system?	Nociceptor stimulation effects the vascular system in several different ways depending on the acute or chronic nature of an event. Acute pain can result in a rapid sympathetic stimulation which signals the vasculature to constrict in the periphery and shunt blood to the heart, lungs and brain to sustain life (fight or flight response). For chronic wounds, the nociceptor signalling can result in a chemical signalling cascade that increases vascular permeability resulting in excessive leakage into the interstitial spaces which increases interstitial pressures and decreases capillary perfusion.
What medication is best for arthritic pain? Is there any way to relieve pain without medication?	There are many types of arthritic pain, so I can't really answer your question well. All arthritic pain is considered neuropathic pain, but the impacting variables can be inflammatory alterations, skeletal alterations, soft tissue alterations, etc.
Do the nociceptors make a transmission to white blood cells to heal the wound during inflammation?	Not directly to white blood cells, but the nociceptors initiate the body's cellular signalling cascade which DOES impact the inflammatory cytokine "soup".
In palliative patient, like cancer of the spine, what would best drug to give to them?	Unfortunately, I can't answer your question because the appropriate treatments are dependent on too many variables including type of pain, depth of pain, quality of pain, area of pain (bone, muscle, tendon, soft tissue, etc…), respiratory status, etc. Just remember, when you are dealing with palliative pain control, there is no "one size fits all" treatment.
How does wound pain turn into nerve pain for long term?	The repeated stimulation or firing of the nociceptors in any given area changes the signalling pathway which can either increase, decrease, eliminate or change the sensory signal the brain receives.
What kind of effect does larvae therapy and negative pressure therapy have on pain?	Initially, both larvae and NPWT therapy are stimulating alpha-delta, alpha-beta and C fibres in soft tissue. The continued stimulation depending on how long you use both, changes the signalling pathways which can result in the increase, decrease or change in the sensory signal the brain receives.

Question	Answer
What are the safest and most effective painkillers for wounds?	The safest painkillers depend on the individual patient physiological characteristics and needs. One patient can be fine with Ibuprofen and the next patient is allergic to it and dies. There is no single answer to your question. SORRY!!
Can packing a deep wound have an effect on nociceptor development?	I honestly don't know the answer to this question, and I don't want to give you "Tami's theory based on what I know about tissue, vessel and neural proliferation!"
Can we use polymeric dressings on chronic leg ulcers?	Absolutely YES! Polymeric membrane dressings work phenomenally well on chronic wounds by controlling both nociceptor firing and the inflammatory signalling cascade.
What topical treatment would you recommend for pain relief?	Unfortunately, I can't answer your question because topical treatments are dependent on too many variables including type of pain, depth of pain, quality of pain, area of pain (bone, muscle, tendon, soft tissue, etc…), absorbent capabilities of a topical agent, etc.
Can PolyMem be used in cavity ulcers?	Absolutely! They even have a specific dressing just for use in cavities, tunnels and undermining called WIC.