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TERAPIJA BOLA KOD PACIJENATA SA POLITRAUMOM

Sažetak: Politrauma označava povredu dva ili više organskih sistema ili fizičke regije, kod kojih je povreda bar jedne regije i/ili vitalnog organa opasna po život, što rezultira kognitivnim, fizičkim, psihosocijalnim ili psihološkim funkcionalnim invaliditetom, prolaznim ili trajnim. Pacijenti sa politraumom pate od različitih vrsta bolova u zavisnosti od prirode zadobijene povrede. Postoje dve osnovne klasifikacije bola: nociceptivni i neuropatski bol. Nociceptivni bol rezultat je nepravilnog funkcionisanja nervnog sistema tela. Pacijenti koji pate od neuropatskog bola (drugi tip) nastalog posle povređivanja pokazuju karakteristike potpunih ili delimičnih promena inervacionih regija. Održiva opcija izrade algoritma terapije neuropatskog bola je procena relativne sigurnosti i efikasnosti koristeći broj potreban da se nanese šteta (NNH) i broj potreban za lečenje (NNT) pristup. Postoje različiti oblici terapije za pacijente koji pate od neuropatskog bola; razne vrste terapija koje mogu pomoći pacijentima s traumom da razumeju vezu uma i tela. Anesteziološke ili neurohirurške tehnike neurolize mogu biti efikasne. Farmakoterapija i druge strategije lečenja bola prvenstveno zavise od potreba i životnog stila pacijenta. Studije pokazuju da pacijenti koji pate od neuropatskog bola pozitivno reaguju na holistički pristup.

Ključne reči: politrauma, nociceptivni bol, neuropatski bol, terapija

Politrauma je stanje u kome pacijenti imaju dve ili više povreda organskih sistema ili fizičkih regija, pri čemu je bar jedna opasnost po život. To rezultira kognitivnim, fizičkim, psihosocijalnim ili psihološkim funkcionalnim onesposobljenjem ili oštećenjima. Ostale definicije politrauma uključuju one koje je predložila Rezolucija o rehabilitaciji, Politrauma o zdravstvu veterana SAD, navodeći da je to povreda više delova tela, koja za posledice ima kognitivna, fizička, psihosocijalna ili psihološka funkcionalna¹. Ostale definicije navode stanja kao što su trauma sa vrednošću na bodovnoj skali težine povrede (ISS) većom od 15, kombinaciju povreda toraksa, abdomena

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i ekstremiteta (bar dva regiona), složene višestruke povrede donjih ekstremiteta ili složeni prelomi acetabuluma ili karlice. Najznačajniji problem koji imaju pacijenti sa politraumom je akutni, a zatim hronična bol.

Traumatska povreda mozga (TBI) obično postoji u politraumi, često u kombinaciji sa drugim povredama centralnog nervnog sistema, poput povrede kičmene moždine, amputacije i post-traumatskog stresnog poremećaja, oštećenja vida ili sluha. Pacijenti sa politraumatskim povredama osećaju bol koji predstavlja različite izazove pre, za vreme i posle rehabilitacionog lečenja.² Tipična terapija za smanjenje akutnog bola kod ovih pacijenata, kao što je primena oralnih opioida, potencijalno ometa aktivnu rehabilitaciju, neophodnu za obnavljanje funkcionalnih sposobnosti. Ipak, efikasno upravljanje bolom je neophodno u okviru intenzivne nege ovih pacijenata. Najsloženiji problem lečenja bola kod pacijenata sa politraumom nalazi se u činjenici da obično postoje brojni izvori bola sa pridruženim simptomima i znakovima.

Pacijenti sa politraumom trpe različite vrste bolova u zavisnosti od prirode zado-bijenih povreda.³ Postoje dve osnovne klasifikacije bola: nociceptivni i neuropatski bol. Nociceptivni bol rezultat je nepravilnog funkcionisanja nervnog sistema organizma. Obično postoji izvor bola, kao što je slomljena kost, problem sa kičmom ili posekoti-na. Zbog toga počinje da deluje mehanizam putem kojeg telesni sistem signalizira mozgu da postoji povreda. Tako se te informacije prenose u mozak, omogućavajući povređenom da postane svestan svoje povrede, preko bola koji oseća.

Nociceptivni bol sastoji se iz dve grupe: radikularnog i somatskog bola. Radikularni bol prvenstveno proizlazi iz iritacije nervnih korena kao što je, na primer, hernijacija kičmenog diska.³ On prati nogu spolja i nadole od nervnog korena koji izlazi iz kičmene moždine do terminalnog grananja nerva. U većini scenarija, ova vrsta bola povezana je sa radikulopatijom (ukočenost, slabost, gubitak refleksa u distribuciji nerva). Somatski bol u ovom primeru pogađa bedra i leđa. Problem sa evaluacijom bola leži često u činjenici da pacijenti sa politraumom često nisu u stanju da daju odgovarajuću anamnezu, pa ni anamnezu bola. Međutim, lekari obično postavljaju tačnu dijagnozu bola, na bazi postojećih anamnestičkih i odgovarajućih dijagnostičkih informacija.

Pacijenti koji pate od neuropatskog bola pokazuju delimična ili kompletna odstupanja distribucije bola od inervacionih područja, koja odgovaraju povredama centralnog i/ili perifernog nervnog sistema. Pored toga, postoji paradoksalna pojava preosetljivosti i bola u denervisanim zonama i njihovoj okolini.⁴ Ovi neurološki problemi se javljaju u različitim uslovima i na različitim lokacijama lezije nerva. Shodno tome, ne postoji nijedan mehanizam u potpunosti odgovoran za održavanje i generisanje svih znakova i simptoma neuropatskog bola. Sveukupno lečenje neuropatskog bola i dalje ostaje problem. Klinička praksa ipak ima sve jače dokaze da postoje grupe lekova koje su uspešne u suzbijanju neuropatskog bola i njegovih posledica. Pored toga, postoji potreba za algoritmom lečenja neuropatskih stanja zasnovan na dokazima.

Direktno poređenje različitih lekova u pogledu njihove efikasnosti i neželjenih efekata bilo bi idealno za pravljenje algoritma. Mogućnost i metodologija takvih poređenja je, međutim, vrlo ograničena. Sledeće, održiva opcija je procena relativne sigurnosti i efikasnosti koristeći pristup „broja potrebnog da se našetiti” (NNH) i „broja potrebnog da izleči” (NNT). Dosadašnja istraživanja i studije pomoću ovog pristupa ocenjuju četiri farmakološke grupe koje su se pokazale uspešnim u upravljanju neuropatskim bolom: antidepresivi, antikonvulzivi, opioidi i antagonisti NMDA.⁵

Rana ispitivanja na antikonvulzivima, poput karbamazepina, nisu ispunila metodološke standarde kao što su broj pacijenata, upotreba validirane mere ishoda i statističke metode. Izračunati NNT dao je, međutim, numerički raspon NNT za trigeminalnu neuralgiju od 1,7 (1,3–2,2). Drugi NNT za bolne dijabetičke neuropatije je bio 2,3, u poređenju sa NNT za terapiju pacijenata koji su doživeli moždani udar od 3,4. Statistički podaci pokazuju da karbamazepin ima kombinovani NNT od 21,7 u neuropatskom bolu.⁵

Prethodno poređenje karbamazepina i oksikarbezepina naglašava značajan analgetski efekat, ali sa manje neželjenih dejstava tokom primene; ovo, međutim, nije potkrepljeno dovoljno referentnim publikacijama. Prema drugoj studiji, fenitoin je pokazao značajne efekte ublažavanja za pacijente koji pate od akutnog bola. Ostali antikonvulzivi sa pozitivnim efektima ublažavanja bola uključuju: valproat kod posthepetičke i dijabetičke neuropatije; gabapentin kod povrede kičmene moždine, posthepetičke neuralgije i bolne dijabetičke neuropatije; pregabalin, lamotrigin kod trigeminalne neuralgije i topiramat.⁶

Davanje opioda intravenski ima značajne efekte kod pacijenata sa perifernim neuropatskim bolom, mešovitim neuropatskim stanjima i drugim vrstama bola centralnog porekla. Međutim, placebo-kontrolisani testovi pokazuju da je dugotrajna oralna primena opioda pogodnija za hronični bol. Na primer, ranija ispitivanja pokazuju da morfin ima pozitivne efekte kod pacijenata sa fantomskim bolovima udova, bolnom dijabetičkom neuropatijom i posthepetičkom neuralgijom, sa NNT od 2,6. Ostali važni opioidi uključuju oksikodon sa NNT od 2,6 i tramadol sa 3,9.⁷ Intravenske infuzije NMDA antagonista mogu značajno olakšati neuropatski bol koji potiče iz različitih izvora. Oralni NMDA antagonisti, poput riluzola, memantina i dekstrometorfana u velikim dozama, imaju značajne efekte ublažavanja bola kod bolne dijabetičke polineuropatije.

Empirijski dokazi iz kontrolisanih ispitivanja pokazuju da triciklički antidepresivi ublažavaju bolnu nedijabetičku i dijabetičku polineuropatiju, postherpetičku neuralgiju, sindrom bola u postmastektomiji i centralni bol. Oni, međutim, imaju neznatne efekte kod fantomskog postamputacionog bola, bolova porekla povrede kičme ili HIV-izazvane neuropatije. Različita stanja u kojima antidepresivi pokazuju značajno ublažavajuće dejstvo su u NNT rasponu od 2 do 3.^{5,7} Ispitivanja bolne polineuropatije sa mešovitim inhibitorima redeponovanja serotonina i noradrenalina (SNRIs) i

selektivnim inhibitorima ponovnog prihvata serotonina (SSRIs) pokazuju da su određeni SNRI neefikasni u ublažavanju bola, poput venlafaksina. Međutim, izveštaj sa kontrolisanog ispitivanja pokazuje da bupropion, i dopamin i inhibitor noradrenalina, ima značajna svojstva ublažavanja bola kod bolne neuropatije različitih etiologija.

Priroda neuropatskih bolova otežava formiranje jedinstvenog algoritma, pa se u većini slučajeva davanje farmakoloških supstanci kombinuje sa različitim vidovima terapije kako bi se postigli idealni efekti ublažavanja bola. Postoje različiti oblici terapije za pacijente koji pate od neuropatskog bola, uključujući topikalne terapije, fizikalne i psihološke terapije.^{6,8} Štaviše, neki algoritmi kupiranja bola koriste druge tehnike kao što su kontrastimulacija i neurolitičke tehnike.

Lokalne terapije su posebno važne kod pacijenata sa malim hiperestetičkim oblastima. Zakrpe koje sadrže ili nedostaju lidokain dostupne su za zaštitu zahvaćenog područja od trenja ili udara i na taj način smanjuju senzorne unose iz ovih područja. Kapsaicin kreme su efikasne, ali pacijenti su skloni bolovima (slično jedenju ljute paprike) kod nanošenja kreme na mesto, mada iskustvo bolova bleđi nakon nekoliko puta upotrebe.^{7,8} Međutim, osećaj ljute paprike vraća se nakon što pacijenti prestanu redovno da koriste kremu i može im biti potreban ponovni period tolerancije. Lokalne terapije su obično lekovi kratkog delovanja i često nemaju željeni efekat.

Fizikalna terapija je sastavni deo neuropatskog upravljanja bolom, jer istraživanja pokazuju da se aktivni ljudi brže prilagođavaju i leče. Mišićni grčevi mogu značajno povećati nivo bola pacijentu, pa je važno da mišići budu relaksirani i aktivni. Dostizanje tačke uobičajene pokretljivosti zgrčenih ili zategnutih mišića značajno će poboljšati nivo funkcionalnosti pacijenta.⁸ Štaviše, pacijenti moraju da podržavaju i održavaju mišićni tonus jer gubitak mišićne podrške i tonusa može dovesti do problema kao što su bolni i zategnuti zglobovi i nestabilnost leđa i cele osovine tela. Bez obzira na to, pacijentima će trebati više farmakoloških supstanci, jer počinju da povećavaju i poboljšavaju aktivnosti. Zaista, u tom stadijumu rehabilitacije zahtev pacijenta da se ublaže bolovi ukazuje da je strategija lečenja i upravljanja bolom uspešna.

Psihološka terapija trebalo bi da predstavlja osnovu za upravljanje bolom kod pacijenata koji pate od neuropatije, zato što pacijenti koji pate od neuropatskih bolova mogu imati ozbiljne psihološke tegobe koje će rezultirati depresijom ako se ne bave njima adekvatno.⁹ Stoga neurolozi/specijalisti koji leče politraumatizovanog moraju da se bave psihološkim pitanjima koja su posledica stanja pacijenta, kao i da budu spremni da upute pacijente kliničkom psihologu, kad se za to ukaže potreba. Pacijentima je potrebno uveravanje da njihov bol nije umišljeno ili preterano reagovanje, kao i ohrabrenje koje osoblje koje neguje politraumatizovanog pokaže kroz razumevanje poteškoća sa kojima se pacijent suočava. Štaviše, pacijentima je potrebno ohrabrivanje da potraže odgovarajuću pomoć relevantnih stručnjaka.

Postoje različite vrste terapija koje mogu pomoći pacijentima s teškom i multiplom traumom da razumeju povezanost uma i tela, omogućavajući im da kontrolišu

bol, umesto obrnuto. Oni uključuju vežbe, slike, hipnozu, biofeedback, akupunkturu, tehnike opuštanja i druge meditativne mogućnosti.¹⁰

Dokazi iz studija CT I MRI snimaka mozga pokazuju da takve terapije pružaju pozitivne psihološke efekte, kao i da povećavaju nivo endogenog endorfina i time poboljšavaju funkciju sistema kontrole bola. Slično farmakoterapeutskim strategijama, vrsta terapije zavisi od potreba i životnog stila pacijenata.

Anesteziološke ili neurohirurške neurolizne tehnike mogu biti neefikasne za pacijente sa procenjenim životnim vekom kraćim od jedne godine. Uvek treba imati u vidu da je bol uporan i otporan pratilac povređivanja: uvek pronalazi put oko „terapeutskih prepreka” i blokova. Stoga je važno imati na umu da dorzalni ganglion korenova perifernih senzornih nerava inervira telo nervnih ćelija. Teoretski, operativni proces može rezultirati prekidanjem kontinuiteta perifernog živca. Shodno tome, centralni sistem bola nastavlja sa svojim funkcijama i prilagođava se nedostatku signala presečenog nerva.¹¹ Konačno, ovo može prouzrokovati porast osetljivosti do takvog nivoa da signal bilo kog intenziteta prouzrokuje akutni odgovor. Istraživanja iz studija pokazuju da se nervi mogu donekle regenerisati posle ozbiljnih povreda, ali u u većini slučajeva u aberantnom obliku, npr. u formi neuroma. Druga mogućnost je aberantna unakrsna stimulacija između takvih neurona, što rezultira bolom.

Tehnike kontrastimulacije uključuju stimulare kičmene moždine, stimulare perifernih nerava i transkutatore. Generalno, stimulansi kičmene moždine se ubacuju pomoću epiduralne igle smeštene u kičmenom kanalu i izazivaju kontrairitaciju na zahvaćenim mestima. Istraživanja pokazuju da „unos” stimulans koji se „konvertuju” i ne doživljavaju kao neprijatni (bolan) u nervni sistem znatno smanjuje nivo neprijatnosti (bola). Ova tehnika stimulacije je veoma efikasna kod jednostranih bolesti udova. Stimulacija perifernog nerva može zahtevati od specijalista za periferni nerv da pregleda i otvori odsečeni nerv.¹² Pacijenti s dramatičnim i dobro definiranim mono-neuropatijama bilježe veći uspjeh sa perifernim stimulatorima živaca nego stimulansi kičmene moždine. Međutim, samo oko polovine uspešnih slučajeva uživa dugoročno olakšanje. Transkutana stimulacija električnog nerva uključuje primenu relativno malih nivoa električne stimulacije na površini kože. Međutim, ove tehnike nisu bile izuzetno uspešne jer su elektrode u kontaktu sa nervnim završecima, a ne u direktnoj vezi.

Može se **zaključiti** da ne postoji jedinstven algoritam ili strategija za upravljanje neuropskim bolom kod pacijenata sa politraumom zbog etiološke prirode stanja. Farmakoterapija i druge strategije lečenja bola prvenstveno zavise od potreba i životnog stila pacijenta. Međutim, najbitnija klinička intervencija koja je od vitalne važnosti za pacijente sa politraumom koji pate od neuropskog bola jeste pružanje stalne podrške, empatije i nade. Ova činjenica se ne može preuveličati. U većini scenarija neuropski bolovi nameću emocionalna i senzorna opterećenja i njima se mora adekvatno pozabaviti. Većina studija pokazuje da pacijenti koji pate od neuropskog bola pozitivno reaguju na holistički pristup lečenju.¹³

Literatura

1. Dobsha, S, Campbell, Rose, Morasco, Benjamin, Freeman, Michelle, Helfand, Mark. Pain in Patients with Polytrauma: A Systematic Review, 2008. Web Feb 21, 2012.
2. D'Amours, Scott, Sugrue, Margret, Dean, Smith. Initial Management of the Poly-trauma Patient: A Practical Approach in an Australian Major Trauma Service. *Scandinavian Journal of Surgery* 91: 23–33, 2010.
3. Pape, Hans-Christoph, Pietzman, Andrew, Schwab, William. Damage Control management in the Polytrauma Patient. New York: Springer Science LLC, 2010. PubMed Health. Pains in Patients with Polytrauma: Summary and Discussion, 2008. Web Feb 21, 2012.
4. Thomas, Richard. Pain Management Task Force: Final Report. Philadelphia: DIANE Publishing Co, 2010.
5. Medscape. Neuropathic Pain: An Update on Effective Management Strategies. Web Feb 21, 2012.
6. Farrar, John. Treating Neuropathic Pain and the Neuropathic Pain Patient. Web, Web Feb 21, 2012.
7. Ebert, Michael. Behavioral and Psychopharmacologic Pain Management. Cambridge: Cambridge University Press, 2010.
8. Boulton, Andrew, Vileikyte. Painful Diabetic Neuropathy in Clinical Practice: New York: Springer, 2011.
9. Moore, Rhonda. Handbook of Pain and Palliative Care: Biobehavioral Approaches for the Life Course. New York: Springer, 2012.
10. Veterans Health Administration. Polytrauma Rehabilitation Procedures, 2008. Web Feb 21, 2012.
11. Tabielian, Terri, Jaycox, Lisa. Invisible Wounds of War: Psychological and Cognitive Injuries, their Consequences, and Services to Assist Recovery. Santa Monica, CA: RAND Corporation, 2008.
12. Lin, Vernon. Spinal Cord Medicine: Principles and Practice. New York: Demos Medical Publishing, 2010.
13. Bennett, Michael. Neuropathic Pain. New York: Oxford University Press, 2009.

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PAIN MANAGEMENT IN POLYTRAUMA PATIENTS

Abstract: Polytrauma is a condition where patients have two or more organ systems or physical regions injuries, with one being life threatening, resulting in cognitive, physical, psychosocial, or psychological functional disability. Polytrauma patients suffer from different types of pains depending on the nature of the traumatic injury they sustain. There are two basic classification of pain: nociceptive and neuropathic pain. Nociceptive pain results from improper functioning of the body's nervous system. Patients suffering from neuropathic pain, (the second type) display characteristics of complete or partial changes in the innervations territories. The viable option for develop a protocol for pain management is to estimate relative safety and efficacy using the number needed to harm (NNH) and the number needed to treat (NNT) approach. There are different forms of therapies for patients suffering from neuropathic pain; various types of therapies that may assist polytraumatic patients to understand the connection of the mind and the body. Anesthesiologic or neurosurgical neurolytic techniques may be effective. Pharmacotherapy and other strategies of pain management depend primarily on the needs and lifestyle of the patient. Studies indicate that patients suffering from neuropathic pain respond positively to a holistic approach.

Key words: polytrauma, nonciceptive pain, neuropathic pain, therapy

Polytrauma is a condition where patients have two or more injuries to organ systems or physical regions, with one being life threatening, resulting in cognitive, physical, psychosocial, or psychological functional disability or impairments. Other definitions of polytrauma include those by US Veteran Health Administration Polytrauma Rehabilitation Center Directive, stating that it is injury to the rain and other body parts resulting from cognitive, physical, psychosocial, or psychological functional disability or impairments.¹ Other definitions state conditions such as trauma with an injury severity scale of more than 15, combination of one upper and

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one lower injury, complex multiple injuries on lower extremes, or complex acetabulum or pelvis fractures. The most significant problem that polytrauma patients experience is chronic pain.

Traumatic Brain Injury (TBI) usually occurs in polytrauma, often in combination with other conditions such as spinal cord injury, amputation, and post-traumatic stress disorder, visual or auditory impairments among others. Patients with polytraumatic injuries experience pain that presents various challenges before, during, and after rehabilitation treatment.² Typical rehabilitation treatment for reducing pain in these patients, such as administration of oral opioids, potentially interferes with active rehabilitation necessary to restore functional capability. Nonetheless, effective pain management is necessary as part of the polytrauma intensive care management. The problem of pain management in polytrauma patients is that there may be numerous sources of pain with unassociated symptoms and signs.

Polytrauma patients suffer from different types of pains depending on the nature of the traumatic injury they sustain³. There are two basic classifications of pain: nociceptive and neuropathic pain. Nociceptive pain results from improper functioning of the body's nervous system. There is usually a source of pain such as a broken bone, a spine problem, or a cut. Consequently, the mechanism through which the body system tells the brain that there is injury begins working. Thus, this information is transmitted to the brain, enabling an individual to become aware of their hurting.

Nociceptive pain comprises of two other classes: radicular and somatic pain. Radicular pain primarily stems from nerve roots irritation such as a disc herniation.^{1,3} It follows the leg down to the nerve distribution from the root nerve at the spinal cord. In most scenarios, this class of pain associates with radiculopathy (numbness, weakness, loss of reflexes in nerve distribution). Somatic pain essentially affects the thigh and back. The problem with back pain is that polytrauma patients may not be in a position to provide appropriate history. However, doctors usually provide exact diagnosis in few cases even with appropriate information.

Patients suffering from neuropathic pain display characteristics of complete or partial changes in the innervations territories that correspond to the central nervous or peripheral system pathology. Additionally, there is paradoxical occurrence of hypersensitivity and pain in denervated zones and their surroundings.⁴ These nerve problems occur in different conditions and different locations of the nerve lesion. Consequently, there is no single mechanism entirely responsible for maintaining and generating all the signs and symptoms in neuropathic pain. Overall treatment of neuropathic pain remains a problem; even though, clinicians have strong evidences that some groups of drugs show significant relevance in relieving neuropathic pains as well as their side effects.

Additionally, there is need for a treatment algorithm based on evidence for treating neuropathic conditions.

A direct comparison of different drugs in both their side effects and efficacy will ideally lead to the best drug for the algorithm. However, the availability of such comparisons is limited. The other viable option is to estimate relative safety and efficacy using the number needed to harm (NNH) and the number needed to treat (NNT) approach. Past research and studies using this approach appraise four pharmacological drug classifications that prove important in the management of neuropathic pain: antidepressants, anticonvulsants, opioids, and NMDA antagonists.⁵

Early trials on anticonvulsants such as carbamazepine did not meet methodological standards such as patient flow, validated outcome measure use, and statistical methods. However, an attempt to compute the NNT gave trigeminal neuralgia NNT combination of 1.7 (1.3–2.2). Another NNT from painful diabetic neuropathy patients was 2.3, compared to the NNT from post-stroke patients of 3.4. Statistics indicate that carbamazepine has a combined NNT of 21.7 in neuropathic pain.⁶

Previous comparison of carbamazepine to oxycarbezpine highlights a considerable analgesic effect, but with fewer side effects while using the latter. However, these trials lack full publication. According to another study, phenytoin displayed considerable pain-relieving effects for patients suffering from acute flare-ups. Other anticonvulsants with positive pain-relieving effects include valproate in post-herpetic and diabetic neuropathy, gabapentin in spinal cord injury, post-herpetic neuralgia, and painful diabetic neuropathy, pregabalin, lamotrigine in trigeminal neuralgia, and topiramate.⁷

Administration of opioids intravenously has had significant effects on patients with peripheral neuropathy pain, mixed neuropathy conditions, and other central components of pain. However, placebo-controlled tests indicate that long-term oral administration of opioids is more appropriate to chronic pain. For instance, earlier trials indicate that morphine has positive effects in patients with phantom limb pains, painful diabetic neuropathy, and post-herpetic neuralgia, with an NNT of 2.6. Other important opioids include oxycodone with an NNT of 2.6 and tramadol with 3.9. Intravenous infusions of NMDA antagonists may considerably relieve neuropathic pain emanating from different origins. Oral NMDA antagonists such as riluzole, memantine, and dextromethorphan in large doses have significant pain-relieving effects on painful diabetic poly-neuropathy.

Empirical evidence from controlled trials indicates that tricyclic antidepressants relieve painful non-diabetic and diabetic poly-neuropathy, post-herpetic neuralgia, post-mastectomy pain syndrome, and central post-stroke pain. However, they have little effects in phantom limb, spinal cord injury pain, HIV-neuropathy pain. The different condition across which the antidepressants provide considerable relieving effects is the NNT range of 2 to 3.⁸ Trials in painful poly-neuropathy with mixed serotonin noradrenalin reuptake inhibitors (SNRIs) and selective serotonin reuptake inhibitors (SSRIs) indicates that certain SNRIs NNT sore of four are ineffective in

relieving pain, such as venlafaxine. However, a report from a controlled trial indicates that bupropion, both a dopamine and noradrenalin inhibitor, has considerable pain-relieving properties on painful neuropathy from different etiologies.⁹

The nature of neuropathic pains makes it difficult for a single algorithm management, thus most cases combine administration of pharmacological drugs with therapies to achieve the ideal pain-relieving effects. There are different forms of therapies for patients suffering from neuropathic pain, including topical therapies, physical therapies, and psychological therapies.¹⁰ Moreover, some management algorithms use other techniques such as counter-stimulation and neurolytic techniques.

Topical therapies are especially important to patients with small hyperesthetic areas. Patches incorporating or lacking lidocaine are available for protecting the affected area against friction or impact, and thus reduce sensory inputs from these areas. Capsaicin creams prove effective, but patients are prone to pain (similar to eating a hot pepper) experiences when applying the cream to the site, though the pain experience fades away after a few times of usage.⁵ However, the hot pepper sensation returns after the patients stops using the cream regularly, and may require a rebuild of tolerance. Topical therapies are generally short acting remedies and often pose difficulties in application.

Physical therapy is integral in neuropathic pain management as research shows that active people adapt and heal faster. Muscle spasms may significantly increase the level of pain, thus it is important to keep the muscles loose and active. A common trigger point of muscles in spasm or tight muscles will significantly improve a patient's functionality level.⁹ Moreover, patients need to support and maintain muscle tone as loss of muscle support and tone may lead to problems such as painful and tight joints, and back instability. Nonetheless, patients may require more pharmacological drugs as they begin to increase and improve activities. Indeed, the requirement of more pain-relieving medication by a patient indicates that that treatment and management strategy is successful.

Psychological therapy should be the foundation of pain management in patients suffering from neuropathy. This is because patients suffering from neuropathic pains may have severe psychological distress that will result to depression if not addressed.¹⁰ Therefore, neurologists have to address psychological issues resulting from the condition of the patient as well as be prepared to make relevant referrals for the patients to psychological services. Patients need the reassurance that their pain is not imaginal or an overreaction, and the encouragement that the caregiver understands the difficulty situation they are experiencing. Moreover, patients need the encouragement to seek appropriate assistance from relevant specialists.

There are various types of therapies that may assist polytraumatic patients to understand the connection of the mind and the body, enabling them to control the pain rather than the other way. They include yoga, imagery, hypnosis, biofeedback, acu-

puncture, relaxation techniques, and other meditative options.¹¹ Evidence from brain imaging studies indicate that such therapies provide positive psychological effects as well as increase the level of endogenous endorphin and the brain's system of pain control. Similar to pharmaco-therapeutic strategies, the type of therapy depends on the needs and lifestyle of patients.

Anesthesiologic or neurosurgical neurolytic techniques may be ineffective to patients with a life expectancy of less than one year as the pain usually returns. Pain has a resilient nature: it always finds a way around blocks imposed externally. Therefore, it is important to note that the dorsal root ganglion of the peripheral sensory nerves hosts the nerve cell body. Theoretically, the surgery process may result to a cut in a peripheral nerve. Consequently, the central pain system proceeds with its functions and adapts to lack of signal from the cut nerve.⁸ Ultimately, this may cause increase in sensitivity to such a point that when any signal comes in; there is an acute response. Research from studies prove that nerves may grow back after sever injury, but in an aberrant manner in most cases, such as neuromas. Another possibility is that there occurs an aberrant cross-stimulation between such neurons, thus resulting to pain.

Counter-stimulation techniques include spinal cord stimulators, peripheral nerve stimulators, and transcutaneous electrical nerve stimulators. Generally, spinal cord stimulators are inserted using an epidural needle positioned in the spinal canal, and causes counter-irritation in affected areas. Research indicates that the non-noxious stimulus input to the nervous system considerably reduces the noxious input levels. This stimulation technique is very effective in unilateral limb diseases, though other areas of the body and bilateral use are still effective. The peripheral nerve stimulation may require a peripheral nerve specialist to examine and open the severed nerve.¹² Patients with dramatic and well-defined mono-neuropathies record a higher success with peripheral nerve stimulators than spinal cord stimulators. However, only about half the successful cases enjoy long-term relief. Transcutaneous electrical nerve stimulation incorporates application of relatively small levels of electrical stimulation on the surface of the skin. However, these techniques have not been overwhelmingly successful because the electrodes are in contact with nerve endings rather than a direct connection.

In conclusion, it is vitally important to note that there is no single algorithm or strategy for managing neuropathic pain in polytrauma patients because of the etiological nature of the condition. Pharmacotherapy and other strategies of pain management depend primarily on the needs and lifestyle of the patient. However, the most essential clinical intervention for polytrauma patients suffering from neuropathic pain is to offer ongoing support, empathy, and hope. This fact cannot be overemphasized. In majority of the scenarios, neuropathic pains impose emotional and sensory burdens, and these must be addressed adequately. Most studies indicate that patients suffering from neuropathic pain respond positively to a holistic approach of physicians' treatment.¹³

References

1. Dobsha, S, Campbell, Rose, Morasco, Benjamin, Freeman, Michelle, Helfand, Mark. Pain in Patients with Polytrauma: A Systematic Review, 2008. Web Feb 21, 2012.
2. D'Amours, Scott, Sugrue, Margret, Dean, Smith. Initial Management of the Poly-trauma Patient: A Practical Approach in an Australian Major Trauma Service. *Scandinavian Journal of Surgery* 91: 23–33, 2010.
3. Pape, Hans-Christoph, Pietzman, Andrew, Schwab, William. Damage Control management in the Polytrauma Patient. New York: Springer Science LLC, 2010. PubMed Health. Pains in Patients with Polytrauma: Summary and Discussion, 2008. Web Feb 21, 2012.
4. Thomas, Richard. Pain Management Task Force: Final Report. Philadelphia: DIANE Publishing Co, 2010.
5. Medscape. Neuropathic Pain: An Update on Effective Management Strategies. Web Feb 21, 2012.
6. Farrar, John. Treating Neuropathic Pain and the Neuropathic Pain Patient. Web, Web Feb 21, 2012.
7. Ebert, Michael. Behavioral and Psychopharmacologic Pain Management. Cambridge: Cambridge University Press, 2010.
8. Boulton, Andrew, Vileikyte. Painful Diabetic Neuropathy in Clinical Practice: New York: Springer, 2011.
9. Moore, Rhonda. Handbook of Pain and Palliative Care: Biobehavioral Approaches for the Life Course. New York: Springer, 2012.
10. Veterans Health Administration. Polytrauma Rehabilitation Procedures, 2008. Web Feb 21, 2012.
11. Tabielian, Terri, Jaycox, Lisa. Invisible Wounds of War: Psychological and Cognitive Injuries, their Consequences, and Services to Assist Recovery. Santa Monica, CA: RAND Corporation, 2008.
12. Lin, Vernon. Spinal Cord Medicine: Principles and Practice. New York: Demos Medical Publishing, 2010.
13. Bennett, Michael. Neuropathic Pain. New York: Oxford University Press, 2009.