Topical Review

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Considering the potential for an increase in chronic pain after the COVID-19 pandemic

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1. Introduction

The COVID-19 pandemic has impacted the lives and health of persons worldwide, with potential for further effects in the future. The experience of living within this pandemic has disrupted daily life across all sectors, including those living with chronic pain (CP), those infected with the coronavirus Severe Acute Respiratory Syndrome (SARS)-CoV2, healthcare providers and essential workers, as well as those who remained physically healthy. The toll of this pandemic extends beyond physical illness, with important psychosocial stressors that include prolonged periods of limited interpersonal contact, isolation, fear of illness, future uncertainty, and financial strain. Uncertainty is fuelled by the constant media coverage, often with conflicting information, differing recommendations by public health authorities in different jurisdictions, and the unknown duration and likelihood of resurgence of this pandemic. In this context, we will examine the potential health consequences of COVID-19 germane to CP, which might be nociplastic, neuropathic, or nociceptive. Specific possibilities might include: (1) CP as part of a postviral syndrome or the result of viral-associated organ damage; (2) worsening of CP due to exacerbation of preexisting pain physical or mental complaints; and (3) CP newly triggered in individuals not infected with COVID by exacerbation of risk factors (poor sleep, inactivity, fear, anxiety, and depression).

Chronic pain must be considered in the context of the biopsychosocial model, which views symptoms as the result of a complex and dynamic interaction between biological, psychological, and social factors.[36,39] Underlying predisposing mechanisms include genetic factors, previous pain experience, and traumatic events that could be physical or emotional.[2] Chronic pain conditions can be triggered by psychosocial stressors or organ-specific biological factors, which may preferentially occur in individuals with a fragile stress response system.[8,10,24,40,47] The COVID-19 pandemic has many characteristics that could potentially increase the prevalence of CP, especially with stressors extending over many months.

The worldwide pain community is invited to consider the possible downstream consequences of COVID-19, not only for patients surviving infection, but also for the wider community that has experienced psychological, social, and economic effects. Although we address these issues from the perspective of physicians practicing in developed countries, many of the consequences discussed will be particularly relevant for people in other countries, with a call for colleagues in Asia, Africa, and South America to enter into this dialogue.

2. Infections as a trigger for chronic pain

Acute viral illnesses often present with myalgia and fatigue, as well as organ-specific symptoms, as seen with influenza, and noted in the H1N1 pandemics of 1918 and 2009, and coronavirus infection during the SARS epidemic.[4,17] Outcomes related to these infections are almost always focused on the immediate response to the acute illness, with little attention to long-term outcomes. In a small study of 22 subjects (21 of whom were healthcare workers) infected during the SARS epidemic, a chronic post-SARS syndrome consisting of fatigue, diffuse myalgia, depression, and nonrestorative sleep persisted for almost 2 years.[27] Similarly, some patients with chronic widespread pain report onset of symptoms after a perceived viral illness.

Although some infections cause specific postinfectious syndromes, there is also a common stereotypical response to any type of infection that is often observed. For example, up to 12% of patients infected with 3 different pathogens, ie, *Ross River virus* (the cause of epidemic polyarthritis), *Coxiella burnetii* (cause of Q fever), and Epstein–Barr virus, experienced a postviral syndrome of pain, fatigue, and memory difficulties for up to 12 months after infection.[15] Although these infections have markedly disparate acute presentations, a stereotypical chronic syndrome occurred at remarkably similar rates and was not predicted by demographic, psychological/psychiatric measures, or microbiological factors.[15] The presence and severity of somatic symptoms during acute infection was closely correlated with the subsequent development of chronic fatigue and pain.

Chronic regional pain and other somatic symptoms can follow other types of acute infection. In a meta-analysis, Halvorson et al. noted that approximately 10% of individuals will develop postinfectious irritable bowel syndrome after an episode of acute viral or bacterial gastroenteritis, with premorbid psychological problems and/or psychosocial stressors recognized as risk factors.[7,13] On a similar note, an episode of acute urinary tract

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infection is evident in a substantial proportion of women who develop interstitial cystitis/painful bladder syndrome.[43]

Collectively, these findings imply that various acute infections are capable of triggering both widespread and regional CP. The evidence also suggests that the inciting infection must be of sufficient severity and duration to disrupt normal activities.[44] Current estimates are that 80% of laboratory-confirmed COVID-19 patients have mild to moderate disease, including both pneumonia and nonpneumonia cases, 13.8% have severe disease, and 6.1% develop critical illness requiring intensive care unit (ICU) admission.[42]

3. Potential health-related consequences of COVID-19

3.1. Chronic pain as a consequence of COVID-19 disease

Persons with COVID-19 may exhibit a broad range of symptoms, beginning with those who are asymptomatic and extending to patients who develop full-blown severe respiratory distress syndrome. Nonspecific constitutional symptoms include fatigue, myalgias, chills, and headaches. Most patients experience symptoms for 1 to 2 weeks with complete resolution, although some require hospitalization. The mortality rate of COVID-19 is on the order of 1% according to estimates published by the Centre for Evidence-Based Medicine.[37] Whether patients with CP are more susceptible to viral infection or the consequences thereof is unknown. Theoretically, the diminished immune response system observed in CP patients could be even further suppressed by factors such as depression, poor sleep, and opioid use, with potential to increase susceptibility to SARS-CoV2.[19,41]

Many individuals with COVID need ICU care, and individuals surviving an illness requiring ICU admission are at increased risk of long-lasting severe functional limitations, psychological distress, and CP. Surveys have reported persistent CP in 38% to 56% of ICU survivors when evaluated 2 to 4 years after ICU admission.[18,34] Quality of life can also be affected for prolonged periods. In a study evaluating 575 patients 6 to 11 years after ICU discharge, many experienced persistent difficulty with mobility (52%), self-care (19%), activities of daily living (52%), pain/discomfort (57%), and cognition (43%).[38]

Mental health is also frequently affected by severe illness. Between 41% and 65% of SARS survivors have experienced persistent psychological symptoms.[20,23] Between 25% and 44% of Hong Kong residents who were infected with SARS and survived were diagnosed with posttraumatic stress disorder (PTSD), and 15% experienced depression for at least 30 months after the illness.[16,22] Posttraumatic stress disorder also occurred in 40.7% of SARS-infected healthcare workers.[22]

3.2. Exacerbation of chronic pain in the absence of actual infection

Some CP patients may experience exacerbation of symptoms resulting from COVID-19 due to both public health and personal issues. Regular medical care may be compromised during lockdown and the ensuing months.[9] Routine clinics may be less accessible or closed, healthcare professionals may be diverted to COVID-19-related activities, and waiting times may be prolonged, especially for medical illnesses such as CP that many consider nonurgent. Patients may be less able or willing to travel for care, or may be fearful of exposure to infection in a public or medical setting. There may be delays in timely access to medications due to reduced prescribing, as well as to pain management procedures considered to be of lesser importance than the care of patients with more urgent illnesses. Reduced clinical encounters with interdisciplinary healthcare team members (eg, physiotherapists, psychologists, and self-help groups) can have adverse consequences. Access to medications may be reduced due to logistical factors or true drug shortages when analgesic medications are diverted to emergency care causing some to turn to alcohol or nonmedically prescribed substances as a desperate measure to relieve poorly managed pain. The rapid evolution of telehealth presents new challenges for clinical care, especially for those not fully comfortable with or without access to digital technology. The economic impact on public health is evident for working patients who may have lost jobs or health insurance and must contend with financial insecurity or even poverty. Another factor to consider is reduced health-related physical activities, which are a vital management strategy for CP, that result from social distancing and isolation, and closure of group activity programs such as gyms and pools.[21] Limited social support will also contribute to poor psychological health.[12] Patients may have a heightened awareness of physical symptoms accompanied by fear that these symptoms are an indication of infection. These numerous and persistent stressors may exacerbate pain, even in the absence of viral illness.

Given these factors, common wisdom might suggest that catastrophic and stressful events such as COVID-19 will inevitably lead to an exacerbation of CP. However, 2 studies performed in the United States just before and after the 9/11 terrorist attacks indicate that not all psychological stressors will trigger or exacerbate CP. Pain complaints and other somatic symptoms did not change among residents of New York and New Jersey who had been surveyed before and after the 9/11 attacks on the World Trade Center.[32] Similarly, pain complaints did not change for patients with fibromyalgia in the Washington, D.C. region during the same period.[32] Daily "hassles" and personally relevant stressors seem to be more likely to cause symptoms than major catastrophic events that do not personally impact the individual.[30] Therefore, the duration of the stress (ie, weeks to months of lockdown in the current pandemic), and the vocational uncertainty and actual loss of jobs, may adversely affecting health outcomes.

Reviews that highlight the role that various catastrophic events have on health suggest a number of factors that may be more important than the intensity of the "stressor" in predicting adverse health outcomes. Female sex, concerns about or the expectation of chronicity, and inactivity or time off work can all trigger pain and other somatic symptoms.[26] Naturally occurring catastrophic events such as earthquakes, floods, or fires seem less likely to lead to chronic somatic symptoms than similarly "man-made" stressful events such as chemical spills or war.[6] Exposure to a multitude of stressors simultaneously, or over time, may also pose significant risk for later somatic and/or psychological sequelae.[14,33] For example, in military personnel, multiple deployments significantly increase the risk for PTSD and other psychiatric conditions, which in turn are highly coprevalent with CP.[46]

3.3. New onset of chronic pain related to psychological stressors

It is not currently known whether COVID-19 will cause an increase in new-onset CP for the population at large. Risk factors for the longitudinal development of CP have been well studied in fibromyalgia and temporomandibular disorders.[11,25,29] Although CP conditions are thought by some to be highly related to stress and distress, studies have consistently shown that high baseline levels of psychological distress are only modestly related to the

development of chronic regional or widespread pain (OR 1.5-2).[25] Regional CP, female sex, and low socioeconomic status are the strongest predictors for the subsequent development of widespread pain.[11,25] Other factors that may contribute to an increase in CP are poor sleep and reduced physical activity. Sleep deprivation can lead to symptoms virtually indistinguishable from widespread pain, fatigue, and diffuse tenderness.[28] Furthermore, the effects of sleep deprivation may be attenuated by physical activity (ie, individuals who remain physically active may be less sensitive to the effects of sleep disruption).[1] Healthcare workers may be at increased risk for development of CP. In a recent Israeli study, 9.7% of a cohort of 206 nurses fulfilled criteria for fibromyalgia, with symptoms strongly correlated with work-related stress and PTSD-related symptoms.[3]

Numerous factors contribute to high stress levels across geographic boundaries. Nearly everyone is exposed to relentless media coverage and conflicting messages, and concerns about contracting SARS-CoV2, routine medical care, family, jobs, and economic issues are pervasive. Those with an underlying mental health disorder are at particular risk for exacerbation. Further stressors relate to social distancing, isolation and quarantine, and in some, grieving a death without the usual social support system. Persistent and extreme stress can lead to severe mental health consequences including an increased suicide rate. There is preliminary evidence that anxiety and depression (16%-28%), self-reported stress (8%), and sleep disturbances are common reactions to this pandemic.[31] During the SARS outbreak in 2003, an historically high suicide rate of 18.6 per 100,000 was reported in Hong Kong.[5] Furthermore, the annual suicide rate in older adults after the SARS epidemic did not return to preepidemic levels, suggesting that factors related to the epidemic had long-term consequences.

4. Immediate consequences of COVID-19 and strategies to mitigate these effects

Recovery from a life-threatening illness can be expected to affect future physical and mental health. Rehabilitation services should be mobilized for both inpatient and outpatient care, with attention paid to staffing issues to ensure access to psychological services, physiotherapy, and occupational therapy.[35] Routine medical care will resume for most patients, and healthcare professionals should be flexible and willing to adapt to new methods of healthcare delivery, especially with regard to telemedicine.[9] Healthcare workers must also adapt to different methods of communicating with colleagues and an increased emphasis on virtual learning and teaching. Those working in mental health must be attuned to the consequences of economic hardship, which could include increased substance abuse, domestic violence, and suicide. Providers working in low- and middle-income countries are particularly disadvantaged by limited healthcare resources and a shortage of healthcare workers.[45] Developed countries should recognize that healthcare crises in underdeveloped countries are constrained by artificial boundaries and continue to participate in efforts led by international organizations such the World Health Organization and International Red Cross. These suggestions can only be implemented if governments and legislators are willing to work in partnership with the healthcare community in accordance with the recommendations of experts.

5. Conclusion

In this unprecedented crisis, the immediate healthcare concerns are directed towards containment and acute patient care. The impact of the COVID-19 pandemic on health will likely be manifested in both infected individuals and in people spared infection, but are nevertheless adversely affected by disruptions in normal life and experience a wide array of physical, psychological, and social stressors. Based on past experience, we postulate that these scenarios may collectively lead to an increase in CP in the immediate and possibly long-term future. Amidst many uncertainties, the research community is urged to study, devise, and implement strategies aimed at mitigating the pain-related health consequences of this pandemic. Some suggestions could include the establishment of registries of infected patients (including those with concomitant CP), designated COVID-19-related clinics to ensure new and follow-up care for infected persons, examination of telehealth as a means of delivering health care, and population surveys to gather public health information related to COVID-19. Epidemiological data should be used to inform future healthcare policies that seek to reduce the magnitude of future epidemics and their myriad consequences on CP and other diseases. The timely recognition of new CP or exacerbations of preexisting CP, prompt and targeted treatment, and strategies to mitigate the potential impact on health are strongly encouraged.

Conflict of interest statement

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References

[1] Ablin JN, Clauw DJ, Lyden AK, Ambrose K, Williams DA, Gracely RH, Glass JM. Effects of sleep restriction and exercise deprivation on somatic symptoms and mood in healthy adults. Clin Exp Rheumatol 2013;31(6 suppl 79):S53–59.
[2] Afari N, Ahumada SM, Wright LJ, Mostoufi S, Golnari G, Reis V, Cuneo JG. Psychological trauma and functional somatic syndromes: a systematic review and meta-analysis. Psychosom Med 2014;76:2–11.
[3] Barski L, Shafat T, Buskila Y, Amital H, Makulin Y, Shvarts B, Jotkowitz A, Buskila D. High prevalence of fibromyalgia syndrome among Israeli nurses. Clin Exp Rheumatol 2020;38(suppl 123(1)):25–30.
[4] Campbell A, Rodin R, Kropp R, Mao Y, Hong Z, Vachon J, Spika J, Pelletier L. Risk of severe outcomes among patients admitted to hospital with pandemic (H1N1) influenza. CMAJ 2010;182:349–55.
[5] Cheung YT, Chau PH, Yip PS. A revisit on older adults suicides and Severe Acute Respiratory Syndrome (SARS) epidemic in Hong Kong. Int J Geriatr Psychiatry 2008;23:1231–8.
[6] Clauw D. The health consequences of the first Gulf war. BMJ 2003;327:1357–8.
[7] Creed F Review article: the incidence and risk factors for irritable bowel syndrome in population-based studies. Aliment Pharmacol Ther 2019;50:507–16.
[8] Crettaz B, Marziniak M, Willeke P, Young P, Hellhammer D, Stumpf A, Burgmer M. Stress-induced allodynia-evidence of increased pain

sensitivity in healthy humans and patients with chronic pain after experimentally induced psychosocial stress. PLoS One 2013;8:e69460.
[9] Eccleston C, Blyth FM, Dear BF, Fisher EA, Keefe FJ, Lynch ME, Palermo TM, Reid MC, Williams ACC. Managing patients with chronic pain during the COVID-19 outbreak: considerations for the rapid introduction of remotely supported (eHealth) pain management services. PAIN 2020; 161:889–93.
[10] Enck P, Mazurak N. The "Biology-First" Hypothesis: functional disorders may begin and end with biology-A scoping review. Neurogastroenterol Motil 2018;30:e13394.
[11] Generaal E, Vogelzangs N, Macfarlane GJ, Geenen R, Smit JH, de Geus EJ, Penninx BW, Dekker J. Biological stress systems, adverse life events and the onset of chronic multisite musculoskeletal pain: a 6-year cohort study. Ann Rheum Dis 2016;75:847–54.
[12] Gunduz N, Usen A, Aydin Atar E. The impact of perceived social support on anxiety, depression and severity of pain and burnout among Turkish females with fibromyalgia. Arch Rheumatol 2019;34:186–95.
[13] Halvorson HA, Schlett CD, Riddle MS. Postinfectious irritable bowel syndrome-a meta-analysis. AmJGastroenterol 2006;101:1894–9.
[14] Heim C, Newport DJ, Bonsall R, Miller AH, Nemeroff CB. Altered pituitary-adrenal axis responses to provocative challenge tests in adult survivors of childhood abuse. Am J Psychiatry 2001;158:575–81.
[15] Hickie I, Davenport T, Wakefield D, Vollmer-Conna U, Cameron B, Vernon SD, Reeves WC, Lloyd A. Post-infective and chronic fatigue syndromes precipitated by viral and non-viral pathogens: prospective cohort study. BMJ 2006;333:575.
[16] Hong X, Currier GW, Zhao X, Jiang Y, Zhou W, Wei J. Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow-up study. Gen Hosp Psychiatry 2009;31: 546–54.
[17] Hui DS, Chan MC, Wu AK, Ng PC. Severe acute respiratory syndrome (SARS): epidemiology and clinical features. Postgrad Med J 2004;80: 373–81.
[18] Korosec Jagodic H, Jagodic K, Podbregar M. Long-term outcome and quality of life of patients treated in surgical intensive care: a comparison between sepsis and trauma. Crit Care 2006;10:R134.
[19] Kosciuczuk U, Knapp P, Lotowska-Cwiklewska AM. Opioid-induced immunosuppression and carcinogenesis promotion theories create the newest trend in acute and chronic pain pharmacotherapy. Clinics (Sao Paulo, Brazil) 2020;75:e1554.
[20] Lee AM, Wong JG, McAlonan GM, Cheung V, Cheung C, Sham PC, Chu CM, Wong PC, Tsang KW, Chua SE. Stress and psychological distress among SARS survivors 1 year after the outbreak. Can J Psychiatry 2007; 52:233–40.
[21] Macfarlane GJ, Kronisch C, Dean LE, Atzeni F, Hauser W, Fluss E, Choy E, Kosek E, Amris K, Branco J, Dincer F, Leino-Arjas P, Longley K, McCarthy GM, Makri S, Perrot S, Sarzi-Puttini P, Taylor A, Jones GT. EULAR revised recommendations for the management of fibromyalgia. Ann Rheum Dis 2017;76:318–28.
[22] Mak IW, Chu CM, Pan PC, Yiu MG, Chan VL. Long-term psychiatric morbidities among SARS survivors. Gen Hosp Psychiatry 2009;31: 318–26.
[23] Maunder RG. Was SARS a mental health catastrophe? Gen Hosp Psychiatry 2009;31:316–17.
[24] McBeth J, Chiu YH, Silman AJ, Ray D, Morriss R, Dickens C, Gupta A, Macfarlane GJ. Hypothalamic-pituitary-adrenal stress axis function and the relationship with chronic widespread pain and its antecedents. Arthritis Res Ther 2005;7:R992–1000.
[25] McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. BestPractResClinRheumatol 2007;21:403–25.
[26] McLean SA, Clauw DJ. Predicting chronic symptoms after an acute "stressor"-lessons learned from 3 medical conditions. MedHypotheses 2004;63:653–8.
[27] Moldofsky H, Patcai J. Chronic widespread musculoskeletal pain, fatigue, depression and disordered sleep in chronic post-SARS syndrome; a case-controlled study. BMC Neurol 2011;11:37.
[28] Moldofsky H, Scarisbrick P. Induction of neurasthenic musculoskeletal pain syndrome by selective sleep stage deprivation. Psychosomatic Med 1976;38:35–44.
[29] Ohrbach R, Fillingim RB, Mulkey F, Gonzalez Y, Gordon S, Gremillion H, Lim PF, Ribeiro-Dasilva M, Greenspan JD, Knott C, Maixner W, Slade G. Clinical findings and pain symptoms as potential risk factors for chronic TMD: descriptive data and empirically identified domains from the OPPERA case-control study. J Pain 2011;12(11 suppl):T27–45.
[30] Pillow DR, Zautra AJ, Sandler I. Major life events and minor stressors: identifying mediational links in the stress process. J Personal Soc Psychol 1996;70:381–94.
[31] Rajkumar RP. COVID-19 and mental health: a review of the existing literature. Asian J Psychiatr 2020;52:102066.
[32] Raphael KG, Natelson BH, Janal MN, Nayak S. A community-based survey of fibromyalgia-like pain complaints following the World Trade Center terrorist attacks. PAIN 2002;100:131–9.
[33] Sapolsky RM. Why stress is bad for your brain. Science 1996;273: 749–50.
[34] Schelling G, Stoll C, Haller M, Briegel J, Manert W, Hummel T, Lenhart A, Heyduck M, Polasek J, Meier M, Preuss U, Bullinger M, Schuffel W, Peter K. Health-related quality of life and posttraumatic stress disorder in survivors of the acute respiratory distress syndrome. Crit Care Med 1998; 26:651–9.
[35] Sheehy LM. Considerations for post-acute rehabilitation for survivors of COVID-19. Ottawa, Ontario, Canada: JMIR public health and surveillance, 2020.
[36] Tanaka Y, Kanazawa M, Fukudo S, Drossman DA. Biopsychosocial model of irritable bowel syndrome. J Neurogastroenterol Motil 2011;17:131–9.
[37] The Centre for Evidence-Based Medicine. Global covid-19 case fatality rates, 2020. Available at: https://www.cebm.net/covid-19/global-covid-19-case-fatality-rates. Accessed 6 May 2020.
[38] Timmers TK, Verhofstad MH, Moons KG, van Beeck EF, Leenen LP. Long-term quality of life after surgical intensive care admission. Arch Surg 2011;146:412–18.
[39] Uceyler N, Burgmer M, Friedel E, Greiner W, Petzke F, Sarholz M, Schiltenwolf M, Winkelmann A, Sommer C, Hauser W. Etiology and pathophysiology of fibromyalgia syndrome: updated guidelines 2017, overview of systematic review articles and overview of studies on small fiber neuropathy in FMS subgroups. Schmerz (Berlin, Germany) 2017;31:239–45.
[40] Van Houdenhove B, Egle UT. Fibromyalgia: a stress disorder? Piecing the biopsychosocial puzzle together. Psychother Psychosom 2004;73:267–75.
[41] van West D, Maes M. Neuroendocrine and immune aspects of fibromyalgia. Biodrugs 2001;15:521–31.
[42] Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, Cuomo-Dannenburg G, Thompson H, Walker PGT, Fu H, Dighe A, Griffin JT, Baguelin M, Bhatia S, Boonyasiri A, Cori A, Cucunuba Z, FitzJohn R, Gaythorpe K, Green W, Hamlet A, Hinsley W, Laydon D, Nedjati-Gilani G, Riley S, van Elsland S, Volz E, Wang H, Wang Y, Xi X, Donnelly CA, Ghani AC, Ferguson NM. Estimates of the severity of coronavirus disease 2019: a model-based analysis. Lancet Infect Dis 2020;20:669–77.
[43] Warren JW, Brown V, Jacobs S, Horne L, Langenberg P, Greenberg P. Urinary tract infection and inflammation at onset of interstitial cystitis/ painful bladder syndrome. Urology 2008;71:1085–90.
[44] Wessely S, Chalder T, Hirsch S, Pawlikowska T, Wallace P, Wright DJ. Postinfectious fatigue: prospective cohort study in primary care. Lancet 1995;345:1333–8.
[45] World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak 2020.. Available at https://apps.who.int/iris/bitstream/handle/10665/331490/WHO-2019-nCoV-MentalHealth-2020.1-eng.pdf. Accessed 15 May 2020.
[46] Xue C, Ge Y, Tang B, Liu Y, Kang P, Wang M, Zhang L. A meta-analysis of risk factors for combat-related PTSD among military personnel and veterans. PLoS One 2015;10:e0120270.
[47] Yavne Y, Amital D, Watad A, Tiosano S, Amital H. A systematic review of precipitating physical and psychological traumatic events in the development of fibromyalgia. Semin Arthritis Rheum 2018;48:121–33.