ACADEMIC

Narrative review: The role of nature, plants, and art in post-operative outcomes

Michaela Rektorysova

Abstract

BACKGROUND

Recovery from surgery is a stressful experience for patients, both physically and psychologically. Previous research has shown that increased stress has effects on post-operative outcomes. Non-pharmacological therapies, such as experiencing nature, may be potential avenues to further improve patient care.

METHODS

PubMed and Google Scholar were searched for the terms "nature," "plants," "surgery," "post-operative outcomes," and "pain."

RESULTS

There were very limited numbers of studies looking into the effect of plants, nature, and art on post-operative outcomes. Those that did exist were relatively low quality in design. Nevertheless, exposure to plants was associated with a slightly reduced systolic blood pressure and reduced self-reported stress levels and pain intensity. Similarly, a retrospective study found that patients in rooms with views of nature consumed less analgesia on days three to five post-operatively, and had a slightly shorter hospital stay. Views of artwork were associated with increased mobilization distance on day one post-operatively, but this association disappeared from day two onwards. Some evidence exists that nature and images of nature can improve pain tolerance in university students, but this may not generalize well to the clinical population.

CONCLUSION

There is limited evidence to support the thesis that the view of plants, nature, or art can improve post-operative outcomes. The papers identified in this review were of low quality with limited statistical power. However, enabling access to nature and art could be an avenue for non-pharmacological improvement of patient outcomes, and high-quality studies are warranted.

Background

Surgery creates multiple stress factors for patients and their bodies, such as post-operative nausea and vomiting, anxiety, and pain. Research has shown that increased stress factors have significant effects on surgical outcomes and the patient's ability to recover from the procedure.[1] These factors, especially pain, decrease mobilisation distance and frequency, resulting in increased occurrence of negative post-operative outcomes.[2] However, the medications prescribed for these stress factors all have potential adverse effects and can create dependence and drug abuse.[3] Therefore, it would be of great benefit to explore other, non-pharmacological options for post-operative pain.

Experiencing nature, such as via potted plants or a window view, has been associated with positive physiological and psychological effects and has been investigated in the past as an option for non-pharmacological post-operative analgesia.[4]

Aims and methods

The aim of this review is to identify and appraise relevant literature to evaluate the role of nature in post-operative outcomes, such as analgesia usage or post-operative mobilisation distance. The articles were selected from a search of Google Scholar and PubMed using the search terms "nature," "plants," "surgery," "post-operative outcomes," and "pain."

Plants as an adjunct to post-operative analgesia

Park et al.undertook a trial where patients were placed in identical rooms post-operatively, with the exposure group's rooms containing 12 plants.[4] This was reported to be a randomised controlled trial, however the patients were placed in rooms based on which rooms were available, therefore true randomisation was not performed. The sample consisted exclusively of 90 patients post-haemorrhoidectomy in South Korea. The study found that the mean length of hospitalisation and level of analgesic intake were not significantly different between the groups. They did find that systolic blood pressure was significantly lower in the exposure group compared to the control. However, this difference was only 3.77 mmHg; therefore, there may not be a practical clinical difference. The patients measured their anxiety levels with the State-Trait Anxiety Inventory (STAI) scale, and the exposure group had statistically significant results in that their anxiety scores were lower than that of the patients in the control group on the day of the surgery and on days one and two post-operatively.

Self-reported pain intensity was found to be significantly lower in the exposure group on days one and two post-operatively. This difference was of 4.88 points and 6.19 points out of 100, on days one and two respectively. During a questionnaire, 96% of the patients in the exposure group indicated the most positive quality of the room they were staying in were the plants, whereas the most positive quality of the control rooms was reported to be the temperature (88%).

Voluntary comments were also collected from patients, and those in the exposure group stated that the plants allowed them to relax and feel less anxious, and that the plants contributed to building a positive image of the hospital. The limitations of this study were its exclusions, which were those over 60 years old, or with chronic conditions such as diabetes, or a history of psychiatric conditions such as depression. Additionally, the study relied on self-reported pain intensity rather than more objective measures, adding to the limitations. Unfortunately, due to the exclusion of a large part of the population and self-reported pain intensity, the findings are unlikely to be generalisable to a greater patient population.

Previous research by Park et al. has shown that pain sensitivity and perception of pain were significantly lower when flowering and pot

plants were present in a simulated hospital room, when compared to the same room without any plants.[5] In this study, 90 female university students were randomly assigned to one of three simulated rooms containing either foliage and flowering plants, foliage plants only, or no plants. A cold pressor test was performed, where the students immersed their hand in 0°C water. The measurements were the duration for which the students were able to hold their hand in the water, self-reported pain scores, and electrodermal activity (EDA). EDA is a measure of autonomic nervous system activity and is used as an indicator of the user's stress response. The study found that the presence of plants resulted in increased tolerance time during the water immersion test, lower self-reported pain scores, and lower EDA responses when compared to those in the control group. Within the exposure groups, those with flowering and foliage plants had a more positive response in all measurements compared to those with only foliage plants.

A randomised controlled trial by Vincent et al. examined the pain tolerance via a cold pressor test of university students when viewing images of nature when compared to a control group viewing a blank screen.[6] The study also examined the differences in vital signs and self-reported mood disturbance. The study randomly allocated a total of 109 participants into four exposure groups, each viewing a different image of nature. The protocol consisted of exposure to the chosen image for a period of 15 minutes while vital signs were recorded, a two-minute cold pressor test, and then a further 15-minute recovery period. The study found that one of the images (called "mixed," featuring a meadow with tree leaves visible around the edges of the image) produced significantly lower pain scores on the cold pressor test compared to the control group. The study also found that another one of the images (called "hazard," featuring tall trees with some of them falling to the ground) did not produce the diastolic blood pressure elevation that the other exposure and comparison groups did.

When evaluating total mood disturbance, the study found that image "hazard" produced a significantly higher score compared to all other groups, including the control group, suggesting that it was the most effective in distraction from the pain. However, in further evaluation, it was found that the image "hazard" received the lowest score in the measurement of positive emotions, therefore, while distracting, it did not result in positive emotions during the trial. The study limitations were the exclusion of chronic illnesses and the study population being exclusively university students. It should also be noted that it is likely that there is a cultural component to how images are perceived, therefore affecting the ability to reproduce these results in all populations.[7]

A study by Ulrich et al. investigated the effect of passive viewing of natural scenes on the post-operative recovery of patients after a cholecystectomy.[8] This was a retrospective study where records of patients between 1972 and 1981 who were assigned to rooms facing the gardens and rooms facing the wall of the building were examined. The patients were then matched for a garden and wall view based on the inclusion criteria of smoking status, being obese or within normal weight limits, sex, age, and floor level. A total of 46 patients were identified, which were then grouped into 23 pairs. The investigation parameters were the number of days of hospitalisation, amount and strength of analgesia used, minor post-operative complications (e.g. headache and nausea), and nursing notes relating to the patient's condition and course of recovery. During post-operative days two to five, there was a statistically significant difference in the mean number of analgesic doses taken by the tree group compared to the wall group, which was lower in the tree group. There was no significant difference in the days before and after that period. There was no significant difference between the groups in terms of minor post-operative complications. A significant finding was that the tree group had shorter post-operative hospital stays, at 7.96 days compared with 8.70 days in the wall group, meaning there is almost a whole day's difference between the groups.

The main limitations of this study were the exclusions (over 70 years old and a history of "psychological disturbances" e.g. depression) and the fact that it was a retrospective study. This conclusion of this study can also not be extended to all built views.

Plants as a potential source of infection and disease

A study by Summerbell et al. investigated the soil of potted plants within hospital rooms for the presence of opportunistic fungal pathogens.[9] A high number of aerially transmissible and infectious mould particles have already been shown to be present in hospitals due to inadequately filtered outdoor air in hospitals.[10] Due to the risk of exposure to immunocompromised patients, despite all technological precautions such as air filtering, indoor plants have also been investigated as a potential source of fungal pathogens. Summerbell et al. chose five indoor plants in the corridor of a hospital in Toronto, Canada, for surface soil samples. Of the 1646 fungal isolates identified in the soil, 14.1% were capable of infecting humans. The most common human fungal isolate was *Aspergillus fumigatus*, a common cause of opportunistic infections. The infectious propagules of *Aspergillus fumigatus* can spread via the air in large numbers when the soil of the plant is disturbed. It is likely that a significant number of propagules are released during watering. The results of this study suggest that indoor plants may pose a risk to immunocompromised patients if a link between plant pathogens and hospital outbreaks was identified.

An article by LaCharity et al. reviewed the research on the role of flowers and plants in hospital acquired infections.[11] They found that *Pseudomonas aeruginosa*, the most frequent causative organism associated with hospital infections, is one of the most commonly found organisms in potted plants. Another organism commonly isolated from potted plants is *Aspergillus fumigatus*, which is a common cause of severe illness in immunocompromised patients. When genotyping was performed, the strains were found to be genotypically distinct. This article therefore suggests that the outbreaks were not caused by the organisms from the plant soil and the infections did not have a single common source. However, due to the conclusions being drawn from a genotyping rather than a phenotyping study and the small sample size (n=5), the findings are not sufficient to support their claims.

If not nature, then what?

In recognising the fact that many wards do not allow plants due to the risk of infection, this review has gone on to identify the use of art as an additional factor affecting post-operative outcomes.

A trial by Bowen et al. examined the effects of staff art on patient mobilisation distance based on sequential allocation from their date of admission.[12] Mobilisation had been found to be effective in decreasing the occurrence of some negative post-operative outcomes.[2] The study population included 90 patients post-cardiac surgery and excluded those who were required to be on bed rest. The groups were separated into the staff art group, a hospital poster group, and empty walls. The study found that there was a statistically significant difference in mobilisation distance on post-operative day one. The staff art group walked a median of 370 feet (112.8 meters), whereas the hospital poster and empty wall group walked a median of 270 feet (82.3 meters). There were no differences in the number of feet walked on day two or the number of times the patients mobilised. The main limitation of this study is the fact that it was not blinded.

Conclusion

The studies reviewed in this article do not have sufficient evidence to support the theory that plants, nature, or images of nature have an effect on pain perception. This is due to their sample size, quality control, and population. One study correlated room view with decreased length of stay and reduced analgesia intake, but this study was also of low quality. . That said, the potential risk is still high, and therefore healthcare centres should continue to follow infection prevention protocols. Lastly, there is some evidence of specific artwork promoting mobilization, though this effect was only significant on day one post-operatively. Art and plants in patient rooms may present a relatively low-cost method for improving patient outcomes, but there

is limited robust evidence. Nevertheless, further investigation is warranted as a facet of holistic patient care beyond pharmacotherapy. Future research should focus on randomised controlled trials of room views, wall art, and potted plants in ward rooms and their effects on post-operative outcomes for various surgeries.

References

1. Fava G. Stress and medical procedures. Edited by M. Johnstone and L. Wallace, Oxford University Press, Oxford, 1990. No. of pages: xiii + 184. Stress Medicine. 1991;7(3):195-195.

2. van der Leeden M, Huijsmans R, Geleijn E, de Lange-de Klerk ESM, Dekker J, Bonjer H J, et al. Early enforced mobilisation following surgery for gastrointestinal cancer: feasibility and outcomes. Physiotherapy. 2015;102(1):103-10.

3. Narita M, Funada M, Suzuki T. Regulations of opioid dependence by opioid receptor types. Pharmacol Ther. 2001;89(1):1-15.

4. Park S, Mattson RH. Ornamental Indoor Plants in Hospital Rooms Enhanced Health Outcomes of Patients Recovering from Surgery. J Altern Complement Med. 2009 Sep;15(9):975-80.

5. Park S, Mattson RH, Kim E. PAIN TOLERANCE EFFECTS OF ORNAMENTAL PLANTS IN A SIMULATED HOSPITAL PATIENT ROOM. Acta Horticulturae. 2004;(639):241-7.

6. Vincent E, Battisto D, Grimes L, McCubbin J. The Effects of Nature Images on Pain in a Simulated Hospital Patient Room. HERD. 2010;3(3):42-55.

7. Pettersson R. Cultural differences in the perception of image and color in pictures. ECTJ. 1982 Mar;30(1):43-53.

8. Ulrich RS. View Through a Window May Influence Recovery from Surgery. Science. 1984 Apr 27;224(4647):420-1.

9. Summerbell RC, Krajden S, Kane J. Potted plants in hospitals as reservoirs of pathogenic fungi. Mycopathologia. 1989 Apr;106(1):13-22.

10. Gage AA, Dean DC, Schimert G, Minsley N. Aspergillus Infection After Cardiac Surgery. Arch Surg. 1970 Sep;101(3):384-7.

11. LaCharity LA, McClure ER. Are plants vectors for transmission of infection in acute care?. Crit Care Nurse Clin North Am. 2003 Mar;15(1):119-24.

12. Bowen MG, Wells NL, Dietrich MS, Sandlin V. Art to heart: the effects of staff-created art on the postoperative rehabilitation of cardiovascular surgery patients. MedSurg Nurs. 2015 Sep 1;24(5):349-55.

About the author

› At the time of writing, Michaela was a Trainee Intern in Christchurch Hospital and a medic in the NZ Army. In her free time she enjoys collecting plants, painting and teaching her cat (Pepper) to fetch.

Acknowledgements

I would like to thank the Vascular Surgical team in Christchurch Hospital who enthusiastically supported this topic for my surgical essay.

Correspondence

Michaela Rektorysova: michaela.rektorysova@gmail.com