IZMIR DEMOCRACY UNIVERSITY HEALTH SCIENCES JOURNAL
IDUHES
e-ISNN:2651-4575

IDUHeS, 2020; 3(2): 157-166

Derleme Makalesi– Review Paper

YAŞLI KARDİYAK CERRAHİ HASTALARINDA DELİRYUM RİSKİNİ ARTTIRAN FAKTÖRLER: SİSTEMATİK DERLEME

FACTORS INCREASING THE RISK OF DELIRIUM RISK IN ELDERLY CARDIAC SURGERY PATIENTS: A SYSTEMATIC REVIEW

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Özet

Kardiyak cerrahi sonrası deliryum insidansının %3-70 arasında değiştiği belirtilmektedir ve bu riskin yaşlı hastalarda fazla olduğu bilinmektedir. Bu derlemede, yaşlı kardiyak cerrahi hastalarında deliryum riskini artıran faktörleri belirleyen araştırmaların sistematik olarak incelenmesi amaçlandı. Konuyla ilgili makalelere ulaşmak için "Pubmed", "Science Direct", "Google Scholar", "Ulakbim Türk Tıp Dizini", "Türk Medline" ve "Google Akademik" veri tabanları "kalp cerrahisi ve deliryum" (cardiac surgery AND delirium) anahtar kelimeleri kullanılarak tarama yapıldı. Kardiyak cerrahi geçiren yaşlılarda deliryum konusuna yönelik Ocak 2016-Haziran 2020 (son beş yıl) arasında yayınlanmış 486 çalışmaya ulaşıldı. Araştırmaya dahil edilme kriterlerine uygun beş yayın çalışma kapsamına alındı. Bu çalışmalar kronolojik sıraya göre, örneklem özellikleri, veri toplama yöntemleri ve elde edilen sonuçları içeren bir düzen içerisinde verildi. İncelenen çalışmalarda; yaş, düşük ejeksiyon fraksiyonu, diyabet, ekstra kardiyak arteriopati, postoperatif atriyal fibrasyon, pnömoni, yüksek kreatinin, uzamış yatış süresi, düşük eğitim düzeyi, hipertansiyon, mitral kapak hastalıkları, atriyal fibrasyon, fiziksel zayıflıkla birlikte hafif bilişsel bozukluğun olması, hiperoksi atakları ve D vitamini eksikliğinin yaşlılarda kardiyak cerrahi sonrası deliryum riskini arttırdığı belirlendi. Yaşlılarda kardiyak cerrahi sonrası deliryum görülme riskini arttıran ameliyat sürecine bağlı risk faktörlerinin olduğu sonucuna varılmıştır. Kardiyak cerrahi geçiren yaşlı hastalarda deliryum insidansını ve ameliyat sonrası deliryumun neden olduğu olumsuz sonuçların azaltılabilmesi için standart tanılama yöntemleri kullanılarak ameliyat sürecinde risk faktörlerinin erken tanılanması önerilmektedir.

Anahtar kelimeler: Yaşlı, kardiyak cerrahi, deliryum, risk faktörleri

Abstract

It is stated that the delirium incidence after cardiac surgery varies between 3% -70%. It is known that this risk is high in elderly patients. In this research, it was aimed to systematically review the articles about the factors that increase delirium risk in the elderly cardiac surgery patients. We searched the key words cardiac surgery and delirium using "Pubmed", "Science Direct", "Google Scholar", "Ulakbilim Turkish Medical Index", "Turkish Medline" and "Google Academic" databases. 486 studies published between January 2016 and June 2020 (last five years), about delirium in elderly patients after cardiac surgery, were found. Five of these studies which are convenient for review criteria were included in this review. These studies are arranged chronologically in a manner of sample features, data gaining methods and the results. In result of these studies; advanced age, patients with lower ejection fraction, diabetes mellitus, extra cardiac arteriopathy, postoperative atrial fibrillation, pneumonia, patients with higher creatinine levels, longer hospital stay, lower education level, hypertension, mitral valve diseases, physical durability, cognitive disorders, hyperoxia and vitamin D deficiency increases the risk of delirium after cardiac surgery for elderly patients. We imported through these studies that there are perioperative risk factors that increase delirium risk after cardiac surgery for elderly patients. It is highly recommended that early recognition of perioperative risk factors with standard diagnosis techniques is essential to decrease the incidence of delirium and unfavorable effects of postoperative delirium after cardiac surgery in the elderly.

Key words: Elderly patients, cardiac surgery, delirium risk factors

Geliş Tarihi (Received Date): 15.08.2020, Kabul Tarihi (Accepted Date): 22.09.2020, Basım Tarihi (Published Date): 30.09.2020
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1. INTRODUCTION

Delirium is a sudden onset neuropsychiatric syndrome with fluctuations throughout the day which is characterized by disturbance in cognitive functions, attention, awareness of environment and perception due to any causes that affect all parts of the brain and that trigger malfunction of the brain (European Delirium Association, American Delirium Society, 2014, pp.141; Janssen et al., 2019, pp.1095-1117). Delirium is a very important health disorder that causes serious health consequences due to the difficulty in recognizing the clinical picture (Ates Bulut, Isık, 2019, pp. 101-107).

Surgery or other medical procedures that include anesthesia are important risk factors which may cause delirium. It is stated that 17 – 61% of patients have delirium after major surgery (Janssen et al., 2019, pp.1095-1117). Delirium risk is much more possible in patients who has undergone cardiac surgery for the reasons; perioperative use of anesthetic agents, hypoperfusion and microembolism throughout the cardiopulmonary bypass (Kavasoğlu et al., 2015, pp.658-664). It is imported that delirium incidence ranges from 3% to 70% after cardiac surgery (Habeeb-Allah, Alshraideh, 2019, pp.1-6).

Delirium is one of the often but preventable and temporary complications of cardiac surgery which increases morbidity and financial costs of hospitalization (Brown, 2015, pp.117-122; EDA, ADS, 2014, pp.; Sugimura et al., 2020, pp.1-8). Postoperative delirium after cardiac surgery is the indication of patients' safety and care as it disturbs the cognitive functions (Brown, 2015, ss.117-122).

Almost half of the elderly patients in hospital has delirium diagnosis (Sarı, Yavuz van Giersbergen, 2017, pp.138-152). Although delirium has a high prevalence in the elderly, it is rarely diagnosed and usually accepted as an unimportant complication of a different disease (Akarsu Ayazoğlu et al., 2012, pp.101-107). If patients' delirium is not diagnosed in time, treatment is delayed and the patients can even lose their life (Yavuz Karamanoğlu et al., 2015, pp.113-129). It is stated that elderly patients especially in intensive care units, have delirium in a higher rate after cardiac and hip surgery (Martinez et al., 2015, pp.196-204). Delirium in the elderly after cardiac surgery is a multifactorial syndrome. For example, cognitive dysfunction is an important risk factor for delirium, and delirium may be a symptom of an underlying medical problem, especially in frail, cognitively impaired elderly people (Ates Bulut, Isık, 2019, pp. 16-21). As the risk factors detected and controlled in time; the patients' discharge time, morbidity and mortality rates decreases (Akarsu Ayazoğlu et al., 2012, pp.101-107).

There are many studies in literature about the delirium after cardiac surgery. However, there is no systematic review about the elderly patients who has undergone cardiac surgery. For this reason, aim of this review to investigate the risk factors causing delirium cardiac surgery patients and to guide the health professionals about the diagnosis, treatment, and the patients' care. In this systematic review we try to find an answer to the question "What are the risk factors that increase the risk of delirium in the elderly cardiac surgery?"

2. METHODS

This systematic review in which all the relevant articles searched. Search was conducted in "Pubmed", "Science Direct", "Google Scholar", "Ulakbilim Turkish Medical Index", "Turkish Medline" and "Google Academic" databases. The search was conducted in Turkish

and English Science Terms with the key words “kalp cerrahisi ve deliryum” and “cardiac surgery AND delirium” in medical subject headings (MeSH).

The search was limited to the full text articles about delirium with qualitative or quantitative methods published in Turkish or English between January 2016 and June 2020 (last five years), in which patients are elderly and undergone cardiac surgery. Studies in other languages, rather than cardiac surgery and delirium, articles of which full texts cannot be reached, thesis, abstracts, summaries, case reports from congresses, books are excluded. Moreover, national, or international relevant articles before 2016 January the first are also excluded. Considering that there may be differences in the definition of elderly, the definitions of elderly people will be taken as reference. No special surgical operation was determined to be examined within the scope of the study. Delirium developing after any surgical operation will be included in the review.

The study selection process is outlined in the Preferred Reporting Items for Systematic Reviews (PRISMA) diagram (Moher et al., 2009) (Fig. 1). First of all investigated the articles (n=486) by scanning the databases as it is seen on the Figure 1, the research process. In the study conducted by scanning databases and the screening process is shown in Figure 1, the titles and abstracts of the articles (n = 486) accessed first were examined. Repetitive studies (n = 6) were excluded, and 462 articles were excluded according to subject content. Among the studies evaluated (n = 18), 5 articles were excluded from the study because the full text could not be reached, and 7 articles were not in qualitative or quantitative research design. Among the articles examined, 5 articles suitable for the purpose of the research were included in the research. Review process can be seen on the Figure 1.

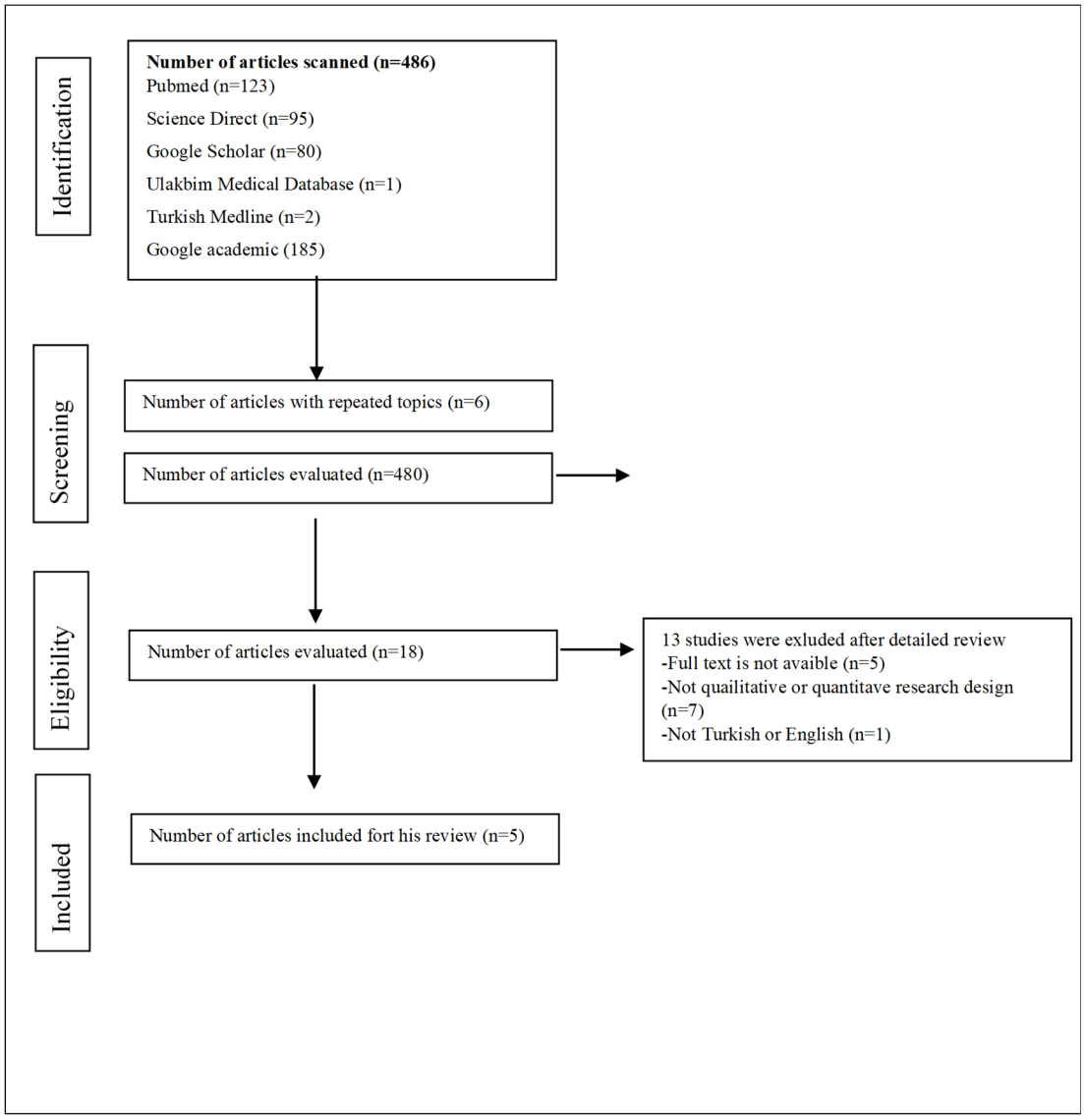

Figure 1. Research Process

3. RESULTS

In this systematic review we included and analyzed five articles that are convenient for inclusion criteria. In the study of Oliveira, elderly individuals were considered over 60 years old, and individuals over 65 years of age were included in the other studies examined. The type of surgical operation considered to have an effect on the systematic review findings has not been explained in detail in the studies examined. The findings from these five articles are classified under the headlines; type of study, sample features, data collecting methods and results (Table 1).

3.1. The features of the samples

The articles included were published between the years 2018 and 2020. The samples of these articles consist of patients over the age of 60. The samples of the articles have at least 89 patients (Itagaki et al., 2020, pp.147-153), at most 2027 patients (Kotfis et al., 2018, pp.1061-1070). Oliveira et al (2018)'s article is a prospective study and the others are retrospective (Itagaki et al., 2020, pp.147-153; Kotfis et al., 2018, pp.1061-1070; Kupiec et al., 2020, pp.7006-7014; Oliveira et al., 2018, pp.1-8; Tumer et al., 2020, pp.113-129).

3.2. Data collecting methods

Imported the risk factors that increase delirium incidence in the elderly cardiac surgery by analyzing the articles, determining the findings preoperative, perioperative and postoperatively which are collected from the patients and the hospital medical records. It was seen that; Confusion Rating Scale Cardiovascular Health Work Survey, Mini Mental Test, Montreal Cognitive Assessment Test Confusion Rating Scale were used as data collection tool in the studies (Itagaki et al., 2020, pp.147-153 Kupiec et al., 2020, pp.7006-7014; Oliveira et al., 2018, pp.1-8).

3.3. The findings of the articles

It is imported that delirium risk of the elderly cardiac surgery ranges from 11.8 % to 34.8% when analyze the articles included (Kotfis et al., 2018, pp.1061-1070; Oliveira et al., 2018, pp.1-8; Itagaki et al., 2010, pp. 147-153; Kupiec et al., 2020, pp.7006-7014; Tumer et al., 2020, pp.264-269).

In the studies examined, it was determined that the factors that increase the delirium risk are age, low ejection fraction, diabetes mellitus, extracardiac arteriopathy, postoperative atrial fibrillation, pnomonia, high levels of serum creatinin level, delayed discharge time, low education level, hypertension, mitral valve diseases, atrial fibrillation, physical weakness of the patients, mild cognitive disorder, hyperoxia attacks, vitamin D deficiency are the majör risk factors that increase the incidence of delirium in the elderly after cardiac surgery (Kotfis et al., 2018, pp.1061-1070; Oliveira et al., 2018, pp.1-8; Itagaki et al., 2020, pp.147-153; Kupiec et al., 2020, pp.7006-7014; Tumer et al., 2020, pp.264-269)

Table 1. The findings of the article

Article	Type of article	Features of the samples	Data collecting methods	Results
Kotfis et al. 2018	Retrospective cohort study	After cardiac surgery; over the age 65: 1797 patients -Over the age 80: 230 patients	-Demographic data -Preoperative, intraoperative and postoperative data	Incidence of delirium: 21.4 %of patients over the age of 65, 33.5% of patients over the age of 80 Delirium risk factors: -Age -Low ejection fraction -Diabetes Mellitus -Extracardiac arteriopathy -Postoperative atrial fibrillation -Pnomonia -High levels of creatinine -Longer duration of hospital stay
Oliveira et al. 2018	Retrospective cohort study	After cardiac surgery; over the age 60: 173 patients	-Demographic data -Preoperative, perioperative and postoperative data -Confusion Rating Scale	Incidence of delirium: 34.1% of all patients Delirium risk factors: -Low education level -Hypertension -Mitral valve diseases -Atrial fibrillatio
Itagaki et al 2020	Retrospective study	After cardiac surgery over the age 65: 89 patients	-Demographic data -Preoperative, intraoperative, postoperative data -Cardiovascular Health Study to evaluate the physical state -Mini Mental Test and Montreal Cognitive Assessment to evaluate the cognitive functions	Incidence of delirium: 34.8% of all patients Delirium risk factors: -Physical weakness -Mild cognitive disorder
Kupiec 2020	Retrospective study	After cardiac surgery over the age 65: 93 patients	-Demographic data -Preoperative, intraoperative and postoperative data -Confusion Rating Scale	Incidence of delirium: 11.8% of all patients -Attacks of hyperoxia increases the risk of delirium
Tumer et al 2020	Retrospective study	After cardiac surgery; over the age 65: 212 patients	-Demographic data -Preoperative, intraoperative and postoperative data	Incidence of delirium: 30.2% of all patients -Vitamin D deficiency increases the risk of delirium

4. DISCUSSION

In this systematic review, included five articles in which factors that increase the risk of delirium in the elderly cardiac surgery were analyzed. In this discussion, these risk factors are classified into three groups as preoperative, intraoperative and postoperative risk factors increasing delirium incidence in the elderly who has undergone cardiac surgery.

It is imported that delirium incidence after cardiac surgery ranges from 3% to 70% in literature (Habeeb-Allah, Alshraideh, 2019, pp.1-6). Although the incidence of delirium after cardiac surgery in the elderly is not clearly found in the literature, article published in 2012, delirium incidence of elderly patients after cardiac surgery reaches up to 29% (Akarsu Ayazoğlu et al., 2012, pp.101-107). In this systematic review the risk of delirium in the elderly after cardiac surgery is between 11.8% and 34.8% (Itagaki et al., 2020, pp.147-153; Kotfis et al., 2018, pp.1061-1070; Kupiec et al., 2020, pp.7006-7014; Oliveira et al., 2018, pp.1-8; Tumer et al., 2020, pp.1-8). Although, findings of the studies included in our systematic review seem to be similar with the literature, it is obvious that the delirium incidence changes a lot from 11.8% to 34.8%. The reason of this wide range of incidence is thought to be because of the difference samples, lack of standard diagnosis of delirium and the variety of the health centers.

Health professionals may neglect or misdiagnose the delirium, despite it is a very common disorder and despite its all negative clinical effects (Kavasoğlu et al., 2015, pp. 658-664). For this reason, it is very crucial to detect all the predisposing risk factors for early diagnosis and on time treatment. Among the risk factors causing delirium after cardiac surgery are older age, males, defect of vision, use of hearing aid, cognitive disorders, dementia, depression, higher blood urea nitrogen levels, low ejection fraction, cerebrovascular diseases, hypertension, low physical condition, smoking, diabetes mellitus, any drug addiction, malnutrition, vitamin B12 deficiency, dehydration, low education level and atrial fibrillation (Akarsu Ayazoğlu et al., 2012, pp.101-107; Balam Yavuz, 2010, pp.78-180; Cerejeira, Mukaetova-Ladinska, 2011, pp.1-12; Kavasoğlu et al., 2015, pp. 658-664; Yavuz Karamanoğlu et al., 2015, pp.113-129). The articles included in this systematic review that preoperative risk factors for delirium in the elderly after cardiac surgery are older ages, low education level, diabetes mellitus, extracardiac arteriopathy, low ejection fraction, hypertension, comorbidities like mitral valve diseases similar to the ones in literature (Kotfis et al., 2018, pp.1061-1070; Oliveira et al., 2018, pp.1-8). Additionally it is imported that physical weakness of the patients, vitamin D deficiency and mild cognitive disorder increase delirium risk in the elderly after cardiac surgery (Itagaki et al., 2020, pp.147-153,; Tumer et al., 2020, pp. 264-269).

It is important that intraoperative risk factors causing delirium after cardiac surgery are aortic surgery, cross clemp duration, cardiopulmonary bypass duration, longer time spent under anesthesia, use of benzodiazepines as anesthesic agent, use of anticholinergic drugs, blood transfusion, level of hematocrit, hypotermia, hypoxemia, serebral hypoperfusion, hypercortisolism and retrograd cardioplegia usage (Akarsu Ayazoğlu et al., 2012, pp.101-107; Cerejeira, Mukaetova-Ladinska, 2011, pp.1-12; Kavasoğlu et al., 2015, pp. 658-664; Koster et al., 2011, pp.197-204; Yavuz Karamanoğlu et al., 2015, pp.113-129). Additional risk factor to the ones in literature is hyperoxia attacks intraoperatively which increases the risk of delirium in the elderly after cardiac surgery as it is mentioned in an article published in Polonia (Kupiec et al., 2020, pp.7006-7014). As the intraoperative risk factors analyzed, mixed surgical procedures causing increase in the duration of cardiac surgery are thought to be the main reason why postoperative delirium incidence seen in a higher percentage.

The postoperative risk factors for delirium discussed in the article of Kotfis et al (2018) are; atrial fibrillation, pneumonia, longer hospital stay and higher levels of serum creatinine level (Kotfis et al., 2018, pp.1061-1070). In literature postoperative delirium risk factors after cardiac surgery are low hematocrit level high blood lactate level, higher BUN/Creatinine ratio, hypoalbuminemia, immobilization, medications given 48 hours postoperatively, sleep disorders, longer intensive care unit stay, hypernatremia, acute renal failure, pneumonia, hypotension, low ejection fraction, atrial fibrillation, diuresis, body fluid imbalances, acute infection and mechanical ventilation (Akarsu Ayazoğlu et al., 2012, pp.101-107; Kavasoğlu et al., 2015, pp.658-664; Koster et al., 2011, pp.197-204; Yavuz Karamanoğlu et al., 2015, pp.113-129).

5. CONCLUSIONS

In conclusion postoperative delirium is a frequent syndrome for elderly patients after cardiac surgery. The risk of delirium in the elderly after cardiac surgery is associated with perioperative risk factors. These are patient related factors, comorbidities, type and methods of surgery, complicated perioperative process. So, in order to prevent delirium in the elderly after cardiac surgery; it is important to make detailed diagnostic tests preoperatively and geriatric consultation for perioperative risk factors and it is important to check the patients frequently if there is any risk factors listed in a chart for every patient. Lastly, it is highly recommended that health professionals working in the cardiac surgery ward should take regular courses to update their knowledge about the risk factors for early diagnosis and treatment of delirium.

6. REFERENCES

Akarsu Ayazoğlu, T., Tür, H., Bolat, C., Özkaynak, İ., & Candan, M. (2012). Yaşlılarda Kardiyak Cerrahi Sonrası Yoğun Bakımda Deliryum Prevalansı Ve Risk Faktörleri. Journal of Experimental and Clinical Medicine, 29(2), 101–107.

Ateş Bulut E & Işık AT.(2019).Deliryum.Türkiye Klinikleri Geriatrik Aciller.16-21

Balam Yavuz, B. (2010). Deliryum Geriatri Uzmanı Gözüyle. Akademik Geriatri, 178–180.

Brown, C. (2015). Delirium in the Cardiac Surgical Intensive Care Unit. Curr Opin Anaesthesiol, 27(2), 117–122. https://doi.org/10.1097/ACO.0000000000000061

Cerejeira, J., & Mukaetova-Ladinska, E. B. (2011). A Clinical Update on Delirium: From Early Recognition to Effective Management. Nursing Research and Practice, 2011, 1–12. https://doi.org/10.1155/2011/875196

European Delirium Association (EDA) & American Delirium Society (ADS) (2014). The DSM-5 Criteria, Level Of Arousal And Delirium Diagnosis: İnclusiveness İs Safer (European Delirium Association and American Delirium Society). BMC Medicine, 12(1), 141. https://doi.org/10.1186/s12916-014-0141-2

Habeeb-Allah, A., & Alshraideh, J. A. (2019). Delirium Post-Cardiac Surgery: Incidence And Associated Factors. Nursing in Critical Care, November, 1–6. https://doi.org/10.1111/nicc.12492

Itagaki, A., Sakurada, K., Matsuhama, M., Yajima, J., Yamashita, T., & Kohzuki, M. (2020). Impact of Frailty and Mild Cognitive Impairment on Delirium After Cardiac Surgery in Older Patients. Journal of Cardiology, 76(2), 147–153.

Janssen, T. L., Alberts, A. R., Hooft, L., Mattace-Raso, F. U. S., Mosk, C. A., & Van Der Laan, L. (2019). Prevention of postoperative delirium in elderly patients planned for elective surgery: Systematic review and meta-analysis. Clinical Interventions in Aging, 14, 1095–1117. https://doi.org/10.2147/CIA.S201323

Kavasoğlu, T., Vural, Ç., Turan, S., Acar, H. V., Kavasoğlu, K., & Erdemli, M. Ö. (2015). Delirium After Open Heart Surgery. Turkish Journal of Thoracic and Cardiovascular Surgery, 23(4), 658–664. https://doi.org/10.5606/tgkdc.dergisi.2015.10797

Koster, S., Henses, A., Schuurmans, M., & Van der Palen, J. (2011). Risk Factors of Delirium after Cardiac Surgery: A Systmatic Review. European Journal of Cardiovascular Nursing, 10(4), 197–204.

Kotfis, K., Szylińska, A., Listewnik, M., Strzelbicka, M., Brykczyński, M., Rotter, I., & Żukowski, M. (2018). Early delirium after cardiac surgery: An analysis of incidence and risk factors in elderly (≥65 years) and very elderly (≥80 years) patients. Clinical Interventions in Aging, 13, 1061–1070. https://doi.org/10.2147/CIA.S166909

Kupiec, A., Adamik, B., Forkasiewicz-Gardynik, K., & Goździk, W. (2020). Intra-Operative Hyperoxia And The Risk Of Delirium İn Elderly Patients After Cardiac Surgery. Aging, 12(8), 7006–7014. https://doi.org/10.18632/AGING.103058

Moher D, Liberati A, Tetzlaff J, Altman DG. (2009) The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med. 6(6): e1000097. https://doi. org/10.1371/journal.pmed.1000097

Martinez, F., Tobar, C., & Hill, N. (2015). Preventing Delirium: Should Non-Pharmacological, Multicomponent İnterventions Be Used? A Systematic Review And Meta-Analysis Of The Literature. Age and Ageing, 44(2), 196–204. https://doi.org/10.1093/ageing/afu173

Oliveira, F. R., Oliveira, V. H., Oliveira, Í. M., Lima, J. W., Calderaro, D., Gualandro, D. M., & Caramelli, B. (2018). Hypertension, Mitral Valve Disease, Atrial Fibrillation And Low Education Level Predict Delirium And Worst Outcome After Cardiac Surgery İn Older Adults. BMC Anesthesiology, 18(1), 1–8. https://doi.org/10.1186/s12871-018-0481-0

Sarı, N., & Yavuz van Giersbergen, M. (2017). Yaşlılarda Deliryum, Demans ve Depresyonun Değerlendirilmesi ve Hemşirelik Bakım Rehberi. Ege Üniversitesi Hemşirelik Fakültesi Dergisi, 33(3), 138–152.

Sugimura, Y., Sipahi, N., Mehdiani, A., Petrov, G., Awe, M., Minol, J., Boeken, U., Korbmacher, B., Lichtenberg, A., & Dalyanoglu, H. (2020). Risk and Consequences of Postoperative Delirium in Cardiac Surgery. Thorac Cardiovasc Surg, 68(5), 1–8.

Tuğlu, C., & Yıldırım, E. (2002). Hastanede Yatarak Tedavi Gören Hastalarda Sık Karşılaşılan Psikiyatrik Bir Sendrom: Deliryum. Trakya Üniversitesi Tıp Fakültesi Dergisi, 19(1), 55–64.

Tumer, N., Tekeli Kunt, A., Günaydın, S., & Özisik, K. (2020). Preoperative vitamin D Level is Associated with Postoperative Delirium After Cardiac Surgery in Paitents Over 65 Years of Age. The Heart Surgery Forum, 23(3), E264-269.

Yavuz Karamanoğlu, A., Gök, F., & Demir Korkmaz, F. (2015). Kalp Cerrahisi Hastalarında Deliryum ve Hemşirelik Bakımı. Ege Üniversitesi Hemşirelik Fakültesi Dergisi, 31(2), 113–1