

Emergence Delirium: Causation, Correlation and Improvements Needed

Holly MacDonell*

Registered Respiratory Therapist, Edmonton, AB, Canada

***Corresponding Author:** Holly MacDonell, Registered Respiratory Therapist, Edmonton, AB, Canada.

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Abstract

Emergence Delirium is a common complication often seen in the post-anesthetic care unit and is poorly understood as well as poorly managed. Often confused with delirium found in the Intensive Care Unit, Emergence Delirium lacks a clear differentiation clinically and is often not even recognized. Due to its significant impact on postoperative care, employees, and patient well-being, there is a need for more specialized studies to be conducted on its etiology. Not only having patient-associated impacts, there is also increased hospital-associated costs, longer duration of stay, and more staff being implemented in patient management. Attending healthcare providers need to be made aware of the condition and current research in relation to risk factors, diagnosis, and current treatment options. Associated risk factors that have been seen to increase the incidence of Emergence delirium are the extreme spectrums of age, the presence of preoperative anxiety, particular anesthetic techniques, specific surgical procedures and poor post-operative pain management. The high need for further research will also be touched on as the condition has a significant impact on the course of patient care and hospital resources. Emergence Delirium contributes to a delayed recovery process, resulting in longer lengths of stay, more resource utilization, higher hospital costs and more staff needed for patient management. The lack of a specific quantification process and measurement tools make recognition of Emergence Delirium under-recognized and undermanaged. A single direct cause of Emergence Delirium still remains unknown, and further research needs to be conducted in regards to compiling a specific scale and protocol to follow in the postoperative process.

Keywords: *Emergence Delirium; Postoperative; Anesthesia; Anesthetic Post-Anesthetic Care Unit; Emergence; Delirium; Recovery*

Emergence Delirium is a behavioral state that occurs during the recovery phase of general anesthesia and is associated with increased patient morbidity and resource utilization [3-5,10,14]. The condition can be characterized by confusion, irritability, disorientation, and inconsolable crying [3,5,17]. A continuous debate, numerous preoperative factors have been associated with the occurrence of Emergence Delirium such as age, preoperative anxiety, anesthetic techniques used, surgical procedures and poor postoperative pain management. Misrecognition as well as the lack of a standardized protocol for such patient management proves to be a current issue as higher hospital costs, increased risk of patient and staff injury, as well as more staff are required [3-5,10,14]. Although many studies have been conducted, Emergence Delirium remains to be a substantial issue clinically and more systematic reviews are imperative in order to gain a better understanding [3,5,7]. The condition needs to be more clearly differentiated from ICU associated delirium and there needs to be development of a standardized protocol to follow in its management [3,5,7]. This paper will focus on Emergence Delirium, by exploring hypothesized risk factors, disputes, associated implications and areas requiring further research.

Types of delirium

According to the American Psychiatric Association's (APA) Diagnostic and Statistical Manual of Mental Disorders (DSM) delirium is defined as an acute change in mental status characterized by inappropriate behaviors, disturbed visual perceptions and disruptions in cognitive abilities derived from an existing medical condition [7,12,13]. The disorder has also been said to cause disturbances in sleep, emotions, as well as fluctuations in levels of consciousness [3,5,7,12].

In the Intensive Care Unit (ICU) setting, Delirium impacts up to 87% of patients being associated with increased mechanical ventilation days, more than two fold yearly medical costs, and it remains to be a significant contributor to morbidity and mortality [5,7,13]. Monitoring and measuring tools are established and in place in the ICU to validate and classify the severity of Delirium [1,7,13]. ICU Delirium can be caused by sleep disturbances, ineffective pain control or represents an underlying medical condition [9,13]. Unfortunately, Emergence Delirium is poorly understood and there is no clear differentiation established between ICU and Emergence Delirium in clinical settings today [3,5,7].

Emergence Delirium is a type of delirium that occurs in patients in the postoperative period during the recovery phase of general anesthesia which is referred to as Emergence [3-5,7,10,14]. The condition was first described by Dr. Eckenhoff (1960) when his patients were demonstrating unexpected erratic behavior in the emergence phase of anesthesia [5,8,10]. Also termed as Emergence Excitement, this form of Delirium is recognized by an acute change in mental status during the immediate post anesthetic period through fluctuating levels of consciousness, inattention, wild thrashing and hallucinations with no effective measures in orientating such patients [1,3,5,8-10,17]. Incidence rates of Emergence Delirium in the Post anesthetic Care Unit (PACU) can occur in up to 80% of surgical procedures and has proven to be a problem in the ability of health care providers to manage their patients appropriately. This runs the risk of physical harm to the surgical site or complications such as self-extubation [4,10,14]. Reported length of Emergence Delirium can vary, but research has shown it is most likely to occur during the first 30 minutes of post-surgical anesthesia and lasts between 15 - 30 minutes [8,10]. In severe cases, the length of duration has been reported to be as long as hours to days proving significant concern for the health-care industry [8,10,15]. The exact etiology of Emergence Delirium remains unknown, but many theories exist on which particular risk factors have associated instances [1,3,8,10].

Predisposing and precipitating factors

A formal causation of Emergence Delirium has yet to be determined and has been thought to be multifactorial rather than solely due to one direct cause [5,7,17]. Influences that have shown an increased instance of Emergence Delirium in recent studies include extremities of age, preoperative anxiety, anesthetic techniques, surgical procedures and presence of postoperative pain [4-8,14,15,18-20].

Age and preoperative anxiety

The extreme spectrums of age have been one of the primary factors found to have a strong role in the development of Emergence Delirium [4,5,7,8,14,18]. The pediatric and geriatric populations have been found to be the most prevalent age groups in showing increased vulnerability to the condition ($p = 0.02$) [5,7,8,14]. Up to 80% of pediatric patients under the age of five, as well as up to 70% of adult patients over the age of 65 years have been found to demonstrate most instances of Emergence Delirium [5,8,9,11]. The most common finding to date in studies within both age ranges seemed to be in relation to neurological physiology, thought to be why these two different age groups seem to present with Emergence Delirium instances [3,5,7,10,11,14]. Theories as to why the geriatric demographic have been associated with the condition are degeneration in neurological status and scarcity in significant neurotransmitters in the brain through advancing age [9,15]. It is also important to consider with older patients that coexisting neurological conditions are often present and should be differentiated prior to the operation [9,15]. Younger patients also exhibit the problem with the theory that their central nervous system is rather under developed, along with preoperative anxiety being a primary exhibitor in this age group [3,9,15,18].

The geriatric population has revealed an increased vulnerability to Emergence Delirium, with up to 70% of surgical patients developing the condition [5,7-9,16]. A common finding in the older population is pre-existing cognitive impairment, which can further increase delirium severity [2,9,15,16]. Although preoperative screening methods are in place for surgical risk, screening tools geared toward Emergence Delirium have yet to be standardized for anticipation purposes in the recovery room [1,3,7,17]. Central nervous system disorders, such as dementia, have been shown to attribute to higher rates of incidence [9,15]. In such patients, it is important to conduct a preoperative assessment in order to establish a baseline cognitive function status, as well as a postoperative evaluation to determine any change in behavior [9]. With advancing age the body's ability to compensate and maintain homeostasis during general anesthesia decreases in efficiency, thus increasing the risk for immediate post-operative disturbances [2,9].

Younger patients also demonstrate an increased incidence in Emergence Delirium, some studies stating it is much more common [3,10,12,14,22]. Today, about 4 million children undergo general anesthesia annually and incidence of Emergence Delirium has ranged as high as 80% [10]. In a cohort study, pediatric patients in the age range of three to six years old demonstrated excess agitation during the recovery process in comparison to older pediatric patients over the age of five, making pre-school aged children the most commonly affected ($p = 0.01$, OR 3.3, 95% CI 1.2-86) [5,8,9,18,22]. In this age group, immaturity in regards to neurological development and emotions have been said to be the likely cause as to why the condition occurs [5,8,9,12,18]. Arguments such as minimal experience in psychological maturity in comparison to older school-aged children, as well as the rapid awakening process in an unknown environment may spark this behavior in younger patients [9,10,15].

Another important factor to consider with these younger patients would be preoperative anxiety and how traumatic the idea of surgery may be for the young child [8,12,16,18]. Up to 65% of pediatric patients about to undergo a surgical procedure with general anesthesia experience anxiety during the preoperative period, with anxious children developing Emergence Delirium six times more likely than those who are less anxious ($p < 0.005$) [8,10,12]. The same study classified each patient's level of anxiety and it was found that patients exhibiting higher levels of apprehension prior to surgery correlated with significantly higher instances of Emergence Delirium symptoms [12,16,22]. A useful preoperative tool to use in determining preoperative anxiety is the modified Yale Preoperative Anxiety Scale (mYPAS) [12,22]. A study by Kain found that out of 791 children the risk of developing Emergence Delirium increased by 10% for each increment of 10 points in the child's preoperative state anxiety score using the mYPAS platform [8,12,22]. This demonstrates that induction behavior has a significant relationship with Emergence Delirium [8,10,12,16,18].

Anesthetic technique

Many studies have been conducted in determining whether Emergence Delirium is related to particular anesthetic techniques or agents used [6,8,17,19]. Anesthesia depresses the central nervous system inhibitory centers, which can cause imbalances in neurotransmitters in the brain thus altering behavior [6,8,9,15]. Research has speculated that the use of Sevoflurane on induction and maintenance of general anesthesia increases the incidence of Emergence Delirium when compared to other agents [6,19,20]. A case report found that after Sevoflurane administration, patients were agitated, restless, combative and not appropriately cognizant of their surroundings in the PACU [6,19,20]. When studied alongside Isoflurane, the occurrence of Emergence Delirium was reported to be up to 20% with Sevoflurane with a longer agitation than with Isoflurane at 7% [19]. A study revealed that children receiving a combination of Sevoflurane and Isoflurane for induction and maintenance were more than twice as likely to experience Emergence Delirium when compared with other means of anesthesia. ($p < 0.0001$) [14]. Although Sevoflurane seems to have the most focus in regards to current studies and evidence, other inhaled anesthetics such as Desflurane and Isoflurane also demonstrated a positive correlation to the cause, though not as significant [6,8,19].

An existing theory suggests that by using low solubility agents such as Sevoflurane or other volatile anesthetics, the risk of emergence delirium may be due to the rapid awakening process from anesthesia ($p < 0.001$) [6,14,19,21]. When compared with other means such as intravenous agents like Propofol, also sharing a rapid recovery profile, Emergence Delirium was four times more common to occur when inhaled anesthetics were used [6,8,19]. In one study, patients receiving Propofol rather than Sevoflurane revealed a decreased incidence of Emergence Delirium, with 0% of patients receiving Propofol developing the condition [21]. Propofol has shown to be an effective adjunct with Sevoflurane in maintaining general anesthesia and in reducing the occurrence of Emergence Delirium, rather than the sole use of Sevoflurane [6,8,10].

Two researchers, Vlajkovic and Singjelic, experimented on the use of Sevoflurane by decreasing the inspired concentration in a step-wise approach at the end of surgery. This caused a less abrupt awakening but still resulted in the incidence of Emergence Delirium, thus disproving the rapid emergence theory [8]. The minimal occurrence of Emergence Delirium with the use of Propofol also further rejects this theory of rapid emergence, as it shares similar recovery properties [6,8]. It seems that the nature of volatile anesthetics has some sort of relation in the development of Emergence Delirium, but the exact etiology remains in question [6,8,17,19].

Surgical procedure

Particular surgical procedures have been associated with the frequency of Emergence Delirium; especially ears, nose and throat (ENT) as well as procedures dealing with the head and neck [1,3,5,10,14,17]. Other surgeries such as breast and abdominal procedures have also been associated, but ENT was found to be the most significant. ($p < 0.001$) [1,4,5,8]. In a prospective cohort study, it was found that ENT procedures were an independent risk factor for the development of Emergence Delirium in both adults and children [1,10,14]. Such procedures include tonsillectomy, thyroidectomy and ophthalmological procedures [3,5,10,14,17]. The thought of why the occurrence is so significant post ENT procedures was speculated by Eckenoff, Kneale and Dripps, that there is a sense of suffocation by patients recovering post procedures, yet there is lack of scientific supporting data [1,3,8,10,14]. This may demonstrate that the subconscious may have a substantial impact on the frequency of Emergence Delirium [3,8]. Although ENT procedures have shown to have a significant role in Emergence Delirium development, the explanation for the cause still remains unclear [3,5,7,14].

Pain

An important consideration to take into account is the presence of post-operative pain in the association of Emergence Delirium [2,4,5,8,14]. A trail from the rapid recovery hypothesis, as during short procedures or the use of low blood soluble agents, the patient wakes from anesthesia prior to when analgesics take their peak effect resulting in significant patient discomfort [4,5,8,19-21]. Many studies suggest that the instance of Emergence Delirium is related to ineffective pain management, proposing that analgesics should be administered as early as during the surgery itself to ensure timely peak effects and avoidance of agitation [1,2,4,5,20].

Other studies have found data that counteracts the pain hypothesis or rather that an invasive or painful procedure needs to occur for the development of Emergence Delirium [8,14]. Such research has revealed that patients undergoing noninvasive and painless procedures with the requirement of anesthesia such as Magnetic Resonance Imaging (MRI) have also been found to result in the incidence of Emergence Delirium [8,14]. This suggests the notion of pain to be too simple a criteria needed in order for this condition to occur, or rather analgesics cannot completely prevent its incidence [8,14]. This makes it seem that the common factor within instances returns back to volatile anesthetics, thus suggesting that more studies need to be conducted in determining what it is about inhaled agents that may cause the condition [6,8,17,19].

Evaluation Limitations

Many scales exist in defining levels of agitation and sedation such as the Riker Agitation-Sedation Scale, the Richmond Sedation-Agitation Scale, the Motor Activity Assessment Scale, and the New Sheffield Sedation Scale [1,3,5,7]. These scales are advantageous as they are simple to employ and easily utilized in emergency situations, but they lack specificity to Emergence Delirium and the recovery room as they are all tailored to the Intensive Care Unit and its environment [1,4,5,7]. A quantification and standardization process needs to be created, as there is no specific scale or systematic method custom-made in determining the presence and severity of Emergence Delirium in the PACU [1,4,5,7].

Implications today

Emergence Delirium has been identified as a significant problem in many ways and presents a challenge in the recovery process for patients and PACU providers [3,5,10,14]. This proves the need for extensive resource utilization, increased costs and risks to patient mor-

bidity [3-5,7]. Common patient risks that often occur are self-extubation attempts, removal of urinary and indwelling catheters, as well as damage to the surgical site when Emergence Delirium presents [4,10,14]. Also, the removal of dressings, drainage tubes and monitors make assessing such patients quite difficult for post-anesthetic care staff [3,4,10,14]. Studies have found that patients experiencing Emergence Delirium are often quite violent, with 86% of patients thrashing and kicking and only 14% being simply incoherent. This demonstrates that Emergence Delirium can be quite dangerous to patients and caregivers [3,4,10,14]. Unrecognized or delayed diagnosis often also occurs resulting in dangerous patient behaviors that can compromise their safety, delay recovery, and increase morbidity [2-5,10,14,15].

Not only patients but PACU staff are also at risk due to the unexpected presentation of Emergence Delirium and inconsolable nature of the state [3,5,10]. The behavior requires more than the usual PACU care staff on shift, with up to six staff members needed to restrain patients, thus necessitating more help on the unit [4,8,10,14]. This also serves to be a problem to night care of patients recovering from anesthesia, since staff scheduling is usually lower in numbers during evenings [4]. A higher requirement of staff is needed in order to watch specific patients at all times and avoid the possibility of other patients being placed at risk as a result of not being monitored or attended as closely as required [4].

Emergence Delirium proves to be costly but has yet to be studied. Such necessities that should be considered in such a study would be the increase in pharmaceutical management as well as efficient required staff numbers needed to work [4,5,7]. Also, damage to surgical sites and repeated removal of dressings proves to be an issue to patient well-being, as well as resource use [3,5,10]. Another important consideration would be length of stay post-surgical procedure for patients in a delirious state during Emergence [4,7]. According to a study, patients exhibiting Emergence Delirium had a significantly longer mean stay than non-agitated patients in the PACU, at a rate of 205 (range 50 - 960) in comparison to 156 minutes in unremarkable cases [4].

The likelihood of Emergence Delirium occurring can be partially based on the current researched data and suggested causative factors [3,5,7,8]. That is, when the preoperative evaluation can take most precedence in anticipation of patients experiencing Emergence Delirium in the PACU [3,7]. Consideration of the factors discussed above such as age, level of anxiety prior, anesthetic agents administered and the operation performed should all be assessed by the attending anesthetist in determining the likelihood of incidence as well as providing a forewarning to PACU staff on report [3,7]. Another limitation is in regard to variations in study methods or rather the lack there of in classifying Emergence Delirium, thus increasing the difficulty in comparing results available to date [3,7,14]. Before a formalized protocol is established, considering hypothesized risk factors is the most effective anticipation method to date [3,7].

Conclusion

Often thought to be synonymous with ICU delirium, Emergence Delirium is its own unique condition that clearly needs to be differentiated when being evaluated and treated [5,7,13]. Emergence delirium continues to be a significant problem in the post-anesthetic care environment interfering with patient recovery and proving to be a challenge to attending staff [3-5,10,14]. Despite decades of extensive research on the condition, the exact etiology remains unknown and the frequency of contradictory theories reveals how misunderstood the condition really is [3,8,15]. No factor can singularly be identified as the sole cause of Emergence Delirium rather it seems to be a multifactorial condition [5,7,17]. By recognizing potential risk factors, it can aid in the anticipation for highly likely cases for the health care team [1,3,7,17]. Since there are so many proposed causes, it is difficult to prevent the condition completely, but rather having the PACU staff aware of the risk can aid in a smoother recovery while Emergence Delirium continues to search for a more thorough understanding [1,3,5,7]. The necessity for a specific evaluation tool is critical in determining severity and appropriate course of treatment [1,3-5,7]. While this condition is quite common, very few studies have determined information on the causes and management strategies [3,5,8,15]. In order to effectively ensure improved cost and resource management, as well as enhanced patient and staff safety, future studies need to be conducted in order to compile specific screening tools, risk identification profiles and a standardized treatment regimen for Emergence Delirium [3,5,7,8,17].

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