International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 04 Issue 05 May 2024

Page No: 974-981

DOI: https://doi.org/10.47191/ijmscrs/v4-i05-31, Impact Factor: 7.949

Be Careful, Ladies! The Potential Damaging Impact of Vaping and Electric Cigarettes for Healing of Post-Caesarean-Section Wounds: A Literature Review

Muhammad Arya Mandalika[1], Ahmad Fawzy[2]

[1]Faculty of Medicine University of Jenderal Soedirman, Indonesia

[2]Department of Surgery Faculty of Medicine University of Jenderal Soedirman – Margono Soekarjo County Hospital, Indonesia

ABSTRACT

Cesarean section (CS) delivery involves surgically delivering the fetus through an incision in the abdominal and uterine walls. Attention to wound care is essential to prevent infections, a common impediment to CS wound healing, with infection rates significantly higher compared to vaginal delivery. Several factors, including age, nutrition, mobilization, infection, circulation, oxygenation, medications, and wound conditions, influence surgical wound healing. Electronic cigarettes (e-cigarettes), popular for their perceived harm reduction, flavors, and ease of use, deliver flavored nicotine doses via aerosolization through battery-powered devices. Studies link e-cigarettes to proinflammatory responses, increased cytotoxicity, and weakened immune defenses during the perioperative period, heightening surgical risks and impeding healing. This review aims to synthesize evidence on vaping's impact on CS wound healing, focusing on e-cigarette chemical components.

KEYWORDS: vaping, electric cigarettes, wound healing, post-cesarean section wound

ARTICLE DETAILS

Published On:
28 May 2024

Available on:
https://ijmscr.org/

INTRODUCTION

Cesarean section (SC) delivery is a surgical procedure in which the fetus is born through an incision in the abdominal wall and uterine wall. In caesarean section, delivery is carried out based on medical indications for both mother and fetus, such as: placenta previa, abnormal appearance or position of the fetus and other symptoms that can endanger the lives of the mother and fetus.[1]

There is post-cesarean section surgery wounds require proper care. Proper wound care is also addressed to prevent infection. Infection is one of the obstacles to the healing process of incisional wounds in caesarean section wounds, because cases of infection in caesarean section 80 times higher compared to vaginal delivery. The wound healing process consists of 3 phases, namely inflammation, proliferation (epithelialization) and maturation (remodelling), each phase has its own characteristics. There are various factors that influence surgical wound healing such as age, nutritional status, mobilization, infection, circulation and oxygenation, medications, and wound conditions.[1]

The food consumed by postpartum mothers must be high quality, nutritious and have sufficient calories. The public needs to pay attention to the consumption of a balanced menu, for example a balanced menu includes healthy food consisting of rice, side dishes, vegetables and one egg every day. Postpartum mothers who abstain from eating will reduce their nutritional needs, so the food they consume should contain protein, lots of fluids, vegetables and fruit. and this will affect the post wound healing process Sectio Caesaria surgery, which results in the wound not healing properly or abnormally.[2]

Lately, electronic cigarettes (e-cigarettes) have garnered significant popularity as an alternative to cigarette smoking due to the alleged harm reduction, availability of luscious flavors, and ease of use.The modern e-cigarette is a small, battery-powered device that delivers a range of flavored nicotine doses through aerosolization. These devices are being used by ex-smokers, current cigarette smokers, and previous nonsmokers. This prominent increase in its acceptance should prompt more research endorsements to study its health risks.[3]

Surgeons face a significant challenge regarding the status of patients with a significant history of cigarette smoking, as it has been shown to cause various postoperative complications, including wound complications, infections, and pulmonary complications. Preoperative smoking cessation for 4 weeks has been demonstrated to help decrease the incidence of such events, making it a modifiable preoperative risk factor. Similarly, e-cigarettes have been shown to be connected to proinflammatory responses, increased cytotoxicity, and impaired immune defenses in the perioperative period. Thus, these effects lead to increased risk for patients undergoing surgery and could debilitate the healing response.[4]

However, there is no information regarding damage and delays in wound healing due to the use of e-cigarettes. Therefore, this review aims to briefly outline and summarize the available evidence regarding the impact of vaping on wound healing after cesarean section with a focus on the chemical components of e-cigarettes.

Overview of Vaping Devices and Chemical Composition

Electronic cigarettes, a form of Nicotine Replacement Therapy (NRT), use battery power to deliver nicotine in vapor form, classified by the World Health Organization (WHO) as an electronic nicotine delivery system (ENDS). Since their introduction to the market, electronic cigarettes and other vaping devices have significantly increased in popularity among both young people and adults. This rise in use stems partly from the public perception that vaping poses fewer health risks compared to conventional smoking. Many vaping enthusiasts believe that traditional smokers can utilize this method as an effective tool to quit smoking. However, despite being marketed as smoke-free, electronic cigarettes are not inherently healthy.

The vapor produced by electronic cigarettes contains various substances including nicotine, water, glycerol, propylene glycol, and flavorings. Each of these components can have health implications, both individually and synergistically. Nicotine, the primary addictive substance, remains a concern due to its well-documented effects on the cardiovascular system and potential to disrupt adolescent brain development. Water, while seemingly harmless, serves as a medium for delivering other compounds deep into the lungs. Glycerol and propylene glycol, commonly used as base liquids, can break down into toxic substances like acrolein and formaldehyde when heated, which are known to cause respiratory irritation and potentially contribute to long-term lung damage.

Flavorings in electronic cigarettes add another layer of complexity. These chemicals, often deemed safe for ingestion, may become harmful when inhaled. Studies have shown that certain flavoring agents can induce cytotoxic effects and contribute to inflammatory responses in lung tissues. For instance, diacetyl, a common flavoring compound, has been associated with bronchiolitis obliterans, a severe lung condition.

The increasing prevalence of vaping among young people raises additional public health concerns. Adolescents who vape are more likely to transition to conventional smoking, undermining decades of progress in tobacco control. The appeal of flavored electronic cigarettes has been particularly strong among teenagers, leading to higher rates of experimentation and continued use. This trend highlights the urgent need for regulatory measures to curb youth access to vaping products and to control the marketing strategies of electronic cigarette companies.

Despite the perception of vaping as a safer alternative, the long-term health effects of electronic cigarette use remain unclear. Current research suggests potential risks, but definitive conclusions require more comprehensive longitudinal studies. Healthcare professionals and policymakers must approach electronic cigarettes with caution, balancing the potential benefits for smoking cessation against the risks of initiating nicotine dependence, especially in non-smokers and youth.[5]

Propylene glycol and vegetable glycerin[6]

Propylene Glycol (PG) constitutes the third type of processed product derived from the processing of propene. Propene, a by-product of fossil fuels, emerges from the refining of petroleum and natural gas. Researchers often find PG in various fermentation processes. It serves numerous industrial applications due to its ability to act as a solvent, humectant, and preservative. PG also features prominently in pharmaceuticals, cosmetics, and food products. This chemical's versatility stems from its compatibility with water, making it a valuable component in formulations that require moisture retention. Vegetable Glycerin (VG), on the other hand, primarily originates from soybeans and other vegetable oils. The production process involves the hydrolysis of triglycerides found in these oils, resulting in a mixture of glycerol and fatty acids. Industries utilize VG extensively for its emollient properties, making it a key ingredient in skincare products, food sweeteners, and as a moisture-preserving agent. Additionally, VG's non-toxic nature and biodegradability contribute to its widespread acceptance and application in various consumer products.

Scientists have studied PG and VG extensively for their roles in various formulations, particularly in the context of e-liquids for electronic cigarettes. PG, known for its ability to carry flavors effectively, provides a throat hit that mimics the sensation of smoking traditional tobacco. VG, with its higher viscosity, produces dense vapor clouds and contributes to a smoother inhalation experience. The combination of PG and VG in different ratios allows for customizable vaping experiences, catering to individual preferences for flavor intensity and vapor production.

Despite their widespread use, both PG and VG have raised health concerns, particularly in the context of inhalation through vaping. Researchers have focused on understanding the potential respiratory and systemic effects of these substances when aerosolized and inhaled. Studies suggest that prolonged exposure to PG and VG vapors could lead to respiratory irritation and inflammation. Additionally, thermal degradation of these compounds at high temperatures can produce potentially harmful by-products, such as formaldehyde and acrolein. In the context of wound healing, PG and VG may influence various biological processes due to their chemical properties. PG, for instance, possesses antimicrobial activity, which could benefit wound management by reducing bacterial load and preventing infection. However, its hygroscopic nature might also cause dehydration of tissues, potentially delaying the healing process. VG, with its moisturizing properties, could support wound healing by maintaining a moist environment conducive to tissue repair. Nevertheless, the potential for irritation and allergic reactions necessitates careful consideration of their use in clinical settings.

Researchers continue to explore the broader implications of PG and VG exposure, particularly through vaping, on overall health. This includes examining their effects on the cardiovascular system, potential for oxidative stress, and impact on cellular and molecular pathways involved in tissue repair and regeneration. As our understanding of these substances evolves, it becomes increasingly important to balance their beneficial applications with potential health risks, ensuring safe and effective use across various domains.[6]

Nicotine[6]

In liquid vape, manufacturers use nicotine to replicate the smoking experience of burning cigarettes. The dosage varies based on user preference, allowing individuals to customize their experience. Besides delivering nicotine, liquid vape produces a "throat hit," a sensation smokers often encounter with traditional cigarettes. This effect occurs due to nicotine's properties.

Nicotine, an alkaloid organic chemical compound with the formula $C_{10}H_{14}N_2$, plays a significant role in the body's physiological response. When inhaled, nicotine stimulates the adrenal medulla glands to release epinephrine (adrenaline). This release triggers several reactions, including the release of glucose from the liver. The body experiences increased heart rate, heightened alertness, and elevated blood pressure as part of this response.

Researchers have found that nicotine interacts with the central nervous system by binding to nicotinic acetylcholine receptors (nAChRs). This binding facilitates the release of neurotransmitters such as dopamine, serotonin, and norepinephrine, which contribute to nicotine's addictive properties. Dopamine release, in particular, creates pleasurable sensations, reinforcing the habit and leading to potential dependence. Furthermore, nicotine influences various bodily functions. It can suppress appetite, which often leads to weight loss in habitual smokers. Additionally, nicotine affects the cardiovascular system by increasing heart rate and constricting blood vessels, which can contribute to the development of cardiovascular diseases over time. Despite these risks, many individuals turn to vaping as an alternative to smoking traditional cigarettes, believing it to be a less harmful option.

The production of liquid vape involves mixing nicotine with a base liquid, typically propylene glycol (PG) and vegetable glycerin (VG). These substances act as carriers for the nicotine and flavoring agents, creating the aerosol inhaled by users. PG provides a stronger throat hit, while VG offers a smoother, sweeter vapor. By adjusting the ratio of PG to VG, manufacturers can further customize the vaping experience to meet user preferences.

The role of nicotine in liquid vape extends beyond mere addiction. Its physiological effects and the complex interplay with other vape components highlight the need for comprehensive research. Understanding these interactions will better inform public health policies and help individuals make more informed decisions regarding vaping and nicotine consumption.

Flavoring agents[7]

Flavor plays a crucial role in the composition of liquid vape, providing distinct tastes and aromas that enhance the vaping experience. Manufacturers typically use materials that are common in food production, ensuring that these ingredients meet Food Grade standards for safety and quality. This adherence to Food Grade labeling implies that the substances used in vape liquids have passed stringent regulations intended for consumable products, reflecting a focus on consumer safety.

Flavoring agents in vape liquids come from various sources, including natural and artificial compounds. Natural flavorings derive from essential oils, extracts, or distillates of fruits, spices, and other botanicals. For instance, vanilla extract, citrus oils, and mint essences frequently appear in vape liquid formulations. Artificial flavorings, on the other hand, consist of synthesized chemical compounds designed to mimic natural flavors. These artificial agents offer the advantage of consistency and stability, often providing a more predictable flavor profile than their natural counterparts. The selection of flavoring ingredients also considers their interaction with the other components of vape liquids, primarily propylene glycol (PG) and vegetable glycerin (VG). PG and VG serve as carriers for the flavor compounds, influencing the intensity and smoothness of the final product. PG, known for its ability to carry flavors effectively, enhances the sharpness and clarity of the taste. VG, with its sweeter profile, contributes to the overall smoothness and produces denser vapor. The ratio of PG to VG in the vape liquid formulation significantly impacts the flavor delivery and the overall vaping experience.

Understanding the chemical properties of flavoring agents is crucial for manufacturers to ensure compatibility with other ingredients and the safety of the end product. Certain flavor compounds can undergo chemical reactions when exposed to heat or mixed with PG and VG, potentially forming harmful byproducts. Therefore, extensive testing and quality control measures are essential to prevent adverse effects and maintain the integrity of the flavor profile.

In addition to enhancing taste, flavorings in vape liquids play a significant role in user satisfaction and retention. The diverse range of available flavors caters to individual preferences, encouraging users to switch from traditional tobacco products to vaping. For instance, fruity flavors like strawberry, mango, and blueberry appeal to users looking for a sweet and refreshing alternative. Dessert flavors such as custard, chocolate, and caramel provide a rich and indulgent experience, while menthol and mint flavors offer a cooling and invigorating sensation. The psychological aspect of flavor choice also impacts user behavior and satisfaction. Many former smokers find that flavorful vape liquids help them transition away from combustible cigarettes by offering a more enjoyable and customizable experience. This sensory satisfaction can play a significant role in reducing cravings and preventing relapse into smoking.

The regulation of flavorings in vape liquids remains a topic of ongoing debate and research. Health authorities and regulatory bodies continuously evaluate the safety of various flavoring compounds, considering their long-term effects on health. Some studies have raised concerns about the potential respiratory and cardiovascular impacts of certain flavoring agents when inhaled. Consequently, regulatory frameworks aim to balance the availability of diverse flavors with the need to protect public health, often resulting in restrictions on specific flavoring compounds deemed harmful.

Advancements in flavor science and technology continue to drive innovation in the vape industry. Researchers and manufacturers explore novel methods to enhance flavor stability, intensity, and safety. Techniques such as microencapsulation, which involves encasing flavor compounds in protective coatings, can improve the longevity and release profile of flavors. Additionally, the development of new synthetic flavoring agents aims to replicate complex natural flavors more accurately while ensuring safety and consistency.

Overall, flavorings are a vital component of vape liquids, significantly influencing the user's experience and satisfaction. By selecting high-quality, food-grade ingredients and employing rigorous testing and quality control measures, manufacturers can provide safe and enjoyable products that cater to a wide range of preferences. As the industry evolves, ongoing research and innovation will continue to enhance the flavor profiles and safety of vape liquids, ensuring that they remain a viable alternative to traditional tobacco products.

Other additives and potential contaminants (e.g., heavy metals, aldehydes) [7]

A recent investigation identified over 500 chemicals within tested vaping cartridges, with the majority falling into the category of carcinogens. E-Liquid, the primary component of electronic cigarettes (ECs), typically comprises four main constituents: nicotine, water, flavorings, and humectants such as propylene glycol (PG) and vegetable glycerin (VG). However, ECs also contain nicotine derivatives (e.g., nitrosnornicotine, nitrosamine ketone), heavy metals, and various flavorings, including aldehydes and complex organic compounds. Furthermore, confirmed toxins found in ECs include formaldehyde, acrolein, acetaldehyde, metallic nanoparticles, benzene, toluene, ethylbenzene, and xylene.

The oncogenic potential of electronic vapor products (EVPs) arises from multiple distinct molecular pathways. Firstly, direct chemical reactions or the formation of carcinogenic byproducts through combustion and pyrolysis processes can lead to oxidative stress, epithelial-mesenchymal transition, and genotoxicity of mitochondrial DNA. These mechanisms contribute to the initiation and progression of cancer within the exposed tissues. Moreover, the presence of heavy metals in ECs raises additional concerns regarding their carcinogenicity. Metals such as lead, cadmium, and nickel have been detected in vaping aerosols, posing a significant risk to respiratory and systemic health. These metals can exert genotoxic effects, disrupt cellular signaling pathways, and promote tumor development through mechanisms such as DNA damage and inflammation. Furthermore, the complex mixture of chemicals present in ECs can interact synergistically to enhance their carcinogenic potential. For example, aldehydes and flavoring compounds may undergo chemical reactions under vaping conditions, producing toxic intermediates that can exacerbate cellular damage and promote tumorigenesis. Additionally, the presence of nicotine in EVPs can modulate cellular signaling pathways associated with cell proliferation, apoptosis, and metastasis, further contributing to their carcinogenic effects.

Overall, the diverse array of carcinogens and toxicants present in ECs underscores the urgent need for comprehensive regulation and public awareness campaigns to mitigate the health risks associated with vaping. Effective strategies should focus on limiting exposure to harmful chemicals, promoting smoking cessation programs, and advocating for evidence-based regulatory policies to safeguard public health. Additionally, continued research efforts are essential to elucidate the mechanistic underpinnings of EVP-induced carcinogenesis and develop targeted interventions for at-risk populations.

Fundamental of Wound Healing[8,9]

- **Hemostasis**

  Homeostasis plays a crucial protective role in wound healing by initiating the cascade of events necessary for tissue repair. The release of protein-containing exudate into the wound triggers vasodilation and the release of histamine and serotonin, facilitating the infiltration of phagocytes into the injured area to remove necrotic tissue. Exudate, a fluid produced from both chronic and acute wounds, serves as a vital component in wound healing by continuously irrigating the wound and maintaining a moist environment. Additionally, exudates supply essential nutrients to the wound and create optimal conditions for the proliferation of epithelial cells.

- **Inflammation and migration**

During the inflammatory stage, characteristic signs such as edema, ecchymosis, redness, and pain manifest as a result of cytokine, chemokine, and growth factor mediation, exerting effects on receptors. This stage initiates the migration of epithelial cells and fibroblasts into the injured area, aiming to replace damaged or lost tissue. Epithelial cells and fibroblasts migrate from the wound edges, rapidly proliferating and covering the wound area, often where clotted blood has formed, facilitating epithelial hardening.

- **Proliferation/Fibroplasia**

The proliferation stage coincides with basal cell migration and proliferation, typically spanning 2-3 days. It encompasses neoangiogenesis, granulated tissue formation, and re-epithelialization. Granulated tissue formation involves the infiltration of capillaries and lymphatic vessels into the wound, while fibroblasts synthesize collagen, providing structural integrity to the newly formed tissue. Epithelial cells undergo hardening to facilitate collagen repair. Fibroblast proliferation and collagen synthesis persist for approximately two weeks, contributing to tissue strengthening and repair.

- **Maturation/Remodeling:**

The maturation stage progresses with the transformation of cellular granulation tissue into an acellular mass, a process influenced by the size of the wound. This stage spans from a few months to up to two years and involves the formation of cellular connective tissue and reinforcement of the new epithelium.

Chemical substances such as cytokines, chemokines, and growth factors orchestrate cellular responses and molecular events at each stage of wound healing. These substances modulate inflammation, cell migration, proliferation, and tissue remodeling through complex signaling pathways. For example, transforming growth factor-beta (TGF-β) family members play pivotal roles in fibroblast activation, collagen synthesis, and extracellular matrix remodeling during the proliferation phase. Similarly, vascular endothelial growth factor (VEGF) promotes angiogenesis, while matrix metalloproteinases (MMPs) facilitate extracellular matrix degradation, both crucial processes in wound repair. Understanding the interplay between chemical mediators and molecular mechanisms is essential for developing targeted therapies to enhance wound healing outcomes.

Impact of Vaping on Post-Caesarean Section Wound Healing

Propylene glycol, a clear, thick liquid, possesses colorless, odorless characteristics and exhibits a sweet taste. It demonstrates miscibility with ethanol, glycerin, and water, yet remains immiscible with mineral oils, while showing compatibility with essential oils. Under low temperatures, propylene glycol maintains stability within tightly sealed containers, but exposure to high temperatures and open environments leads to oxidation. Due to its hygroscopic nature, propylene glycol requires storage in tightly sealed containers, shielded from light, and in cool, dry conditions. Notably, propylene glycol should not be mixed with oxidizing agents like potassium permanganate and is known to be more irritating to the skin compared to glycerin. Nicotine, upon binding to nicotinic receptors on postganglionic peripheral sympathetic nerve endings in the heart, stimulates increased exocytotic release of norepinephrine. Consequently, norepinephrine binds to β-adrenergic receptors in heart tissue, augmenting pulse rate and contractility, while its release in blood vessel tissue binds to α-adrenergic receptors, inducing vasoconstriction. This vasoconstriction leads to elevated blood pressure following acute nicotine exposure, accompanied by activation of the baroreflex, which suppresses central sympathetic nerve outflow. Commercially available e-liquid flavor compounds contribute to the diversity of vaping experiences. However, studies have indicated that certain flavorings integrated into e-cigarettes exhibit cytotoxic effects. Diacetyl, a prominent organic compound commonly utilized alongside flavoring mixtures in e-liquids, belongs to the diketone class and is renowned for its distinct buttery taste. While diacetyl is deemed safe for oral consumption and is FDA registered as an ingredient for such, its safety when heated and vaporized for inhalation remains uncertain. Consequently, the toxicology profile of e-liquid flavoring compounds remains inadequately understood, necessitating further investigation into their potential health implications.[10]

Electrolytic smoking devices, upon contact with e-liquid, have the potential to release metals into the solution. Heavy metals such as cadmium, arsenic, mercury, lead, chromium, aluminum, iron, tin, and nickel found in e-cigarettes can act as oncogenic agents. The contamination of e-cigarettes with heavy metals primarily occurs during ion mobilization when the device is heated. Inorganic compounds may interact directly with metals or form complexes with aldehydes and ketones present in the e-liquid. This mechanism of metal leaching and reaction can lead to oxidative stress through the generation of free radicals, direct genotoxic effects mediated by metals or ions, and alterations in stem cell function or gene expression. Smoking induces inflammation in the body by impacting various immune responses. Studies have demonstrated that smoking increases neutrophil count while diminishing neutrophil chemotaxis, migration, enzyme release, and bactericidal activity. Additionally, smoking affects monocyte migration, macrophage function, and promotes the production of oxygen radicals, impairing phagocytosis and leading to excessive collagen breakdown. Changes in the levels of matrix metalloprotease enzymes further contribute to the inflammatory response elicited by smoking. While evidence regarding the specific effects of electronic cigarettes on wound healing is limited, the gas composition of e-cigarettes is comparable to that of traditional cigarettes. Therefore, it is plausible that electronic cigarettes exert similar detrimental effects on wound healing as conventional smoking. It is imperative to recognize the potential adverse effects of metal contamination from electrolytic smoking devices and the inflammatory consequences of smoking on wound healing processes. Further research is warranted to elucidate the precise mechanisms by which heavy metals and smoking impede wound healing, particularly in the context of electronic cigarette use. Understanding these mechanisms will aid in developing targeted interventions to mitigate the impact of smoking-related factors on wound healing outcomes.[11]

Review of Clinical and Experimental Evidence[12]

The findings of conducted research unequivocally demonstrate the inflammatory and infective potential of e-cigarettes. Moreover, the deterioration in the health status of vital organs such as the lungs, heart, blood vessels, brain, and liver underscores the equivalence in harmful health impacts between e-cigarettes and traditional tobacco cigarettes. Notably, the acute effects experienced by e-cigarette users pose more immediate threats than the chronic consequences. Research indicates a staggering 56% increase in the risk of cardiovascular disease, a 30% elevation in stroke incidence, and a 10% rise in coronary heart disease associated with e-cigarette use.

Investigations into wound healing dynamics among smokers suggest that particle deposition resulting from smoking may impede nutrient transport crucial for tissue repair, or the compromised quality of transported blood may fail to adequately support tissue healing processes. Notably, smokers tend to exhibit delayed wound healing, albeit with some instances of optimal healing. However, comparative analyses against non-smokers consistently reveal slower wound healing trajectories.

Microscopic examinations of human tissues hold promise for elucidating intricate associations between smoking history and wound healing kinetics. Although this study primarily undertook clinical observations of wound healing, compelling evidence emerged delineating a significant correlation between smoking habits and the duration of the wound healing process. Such microscopic analyses offer invaluable insights into the cellular and molecular mechanisms underpinning the observed clinical outcomes, potentially uncovering novel targets for therapeutic interventions aimed at expediting wound healing in smokers. Furthermore, longitudinal studies integrating both clinical and microscopic assessments could offer a comprehensive understanding of the multifaceted influences of smoking on wound healing dynamics, thereby informing more tailored therapeutic strategies for this population.

DISCUSSION

Surgeons encounter a formidable challenge concerning patients with a significant history of cigarette smoking, given its association with various postoperative complications such as wound complications, infections, and pulmonary issues. Preoperative smoking cessation for 4 weeks has been validated as an effective strategy to mitigate the incidence of such complications, rendering it a modifiable preoperative risk factor. Additionally, e-cigarettes have been implicated in eliciting proinflammatory responses, heightened cytotoxicity, and compromised immune defenses during the perioperative period, thereby amplifying the risk for surgical patients and potentially impeding the healing process.[13]

Numerous alternatives exist to aid in smoking cessation, encompassing both pharmacological and non-pharmacological interventions. Pharmacological interventions include the administration of bupropion, varenicline, and clonidine. However, each of these drugs is associated with its own set of adverse effects. Varenicline, for instance, may induce gastrointestinal symptoms such as nausea, vomiting, constipation, and dyspepsia, as well as headaches, insomnia, and nightmares. Clonidine may lead to dry mouth and sedation, while bupropion can result in insomnia, dry mouth, and cramps.

Among non-pharmacological therapies, reducing the daily cigarette consumption and refraining from substituting traditional cigarettes with electronic cigarettes represent potential strategies to break the habit or addiction to tobacco cigarettes. It is crucial to recognize that e-cigarettes do not serve as a smoking cessation therapy, as they contain nicotine and can perpetuate addiction. Quitting smoking constitutes a complex and challenging endeavor for cigarette users, even when they possess an understanding of the hazards associated with smoking.

Furthermore, understanding the implications of smoking on wound healing, particularly in the context of post-caesarean wounds, is paramount. Delayed healing in post-caesarean wounds among smokers may result from nicotine-induced vasoconstriction, which compromises tissue perfusion and oxygenation, thereby impeding the inflammatory and proliferative phases of wound healing. Additionally, nicotine has been shown to suppress immune function and impair collagen synthesis, further hampering the healing process. These insights underscore the critical importance of smoking cessation interventions in optimizing surgical outcomes, particularly in vulnerable populations such as women undergoing caesarean sections.[13]

CONCLUSION

Studies have demonstrated that e-cigarettes induce proinflammatory responses, elevate cytotoxicity levels, and compromise immune defenses during the perioperative period. Consequently, these effects heighten the vulnerability of surgical patients and may impede the natural healing process. Individuals with a substantial smoking history face elevated risks of postoperative complications, such as wound issues, infections, and pulmonary challenges. The pervasive culture of smoking within society has entrenched it as a habit with far-reaching detrimental consequences, both direct and indirect, evident across various disease pathologies.

Moreover, the impact of smoking on wound healing, particularly in the context of post-caesarean wounds, warrants thorough investigation. Maternal smoking during pregnancy has been linked to delayed wound healing and increased postoperative complications in caesarean delivery. The complex interplay between smoking-related factors, such as nicotine, carbon monoxide, and other harmful constituents, exacerbates tissue damage and impairs the physiological processes crucial for wound repair. Furthermore, compromised vascular function and immune dysregulation induced by smoking may prolong inflammation and hinder the formation of granulation tissue, leading to delayed wound closure and increased susceptibility to infections in post-caesarean wounds.

Understanding the intricate mechanisms underlying delayed wound healing in post-caesarean wounds necessitates a comprehensive evaluation of the multifaceted effects of smoking on maternal and fetal health. Nicotine, as a vasoconstrictor, disrupts local blood flow, impairing oxygen and nutrient delivery to the wound site, thereby compromising tissue regeneration. Additionally, the proinflammatory effects of smoking disrupt the delicate balance of cytokines and growth factors involved in the wound healing cascade, prolonging the inflammatory phase and impeding subsequent tissue remodeling processes essential for wound closure.

Addressing the challenge of delayed wound healing in post-caesarean wounds requires a multifaceted approach encompassing smoking cessation interventions, optimized perioperative care strategies, and targeted therapeutic interventions tailored to mitigate the adverse effects of smoking on wound repair processes. By elucidating the specific pathways through which smoking influences wound healing dynamics in the context of caesarean delivery, clinicians can develop tailored interventions to optimize maternal and neonatal outcomes and minimize the burden of postoperative complications associated with smoking. Thus, a deeper understanding of the interplay between smoking and wound healing mechanisms holds significant implications for clinical practice and underscores the importance of comprehensive smoking cessation initiatives in improving surgical outcomes and promoting maternal and fetal health.

REFERENCES

I. Schreml S, Szeimies R-M, Prantl L, Landthaler M, Babilas P. Wound healing in the 21st Century. Journal of the American Academy of Dermatology. 2010 Nov;63(5):866–81. doi:10.1016/j.jaad.2009.10.048

II. Zhang J, Guan J, Niu X, Hu G, Guo S, Li Q, et al. Exosomes released from human induced pluripotent stem cells-derived mscs facilitate cutaneous wound healing by promoting collagen synthesis and angiogenesis. Journal of Translational Medicine. 2015 Feb 1;13(1). doi:10.1186/s12967-015-0417-0

III. Diegelmann R F. Wound healing: An overview of acute, fibrotic and delayed healing. Frontiers in Bioscience. 2004;9(1–3):283. doi:10.2741/1184

IV. Bigliardi PL, Neumann C, Teo YL, Pant A, Bigliardi-Qi M. Activation of the δ-opioid receptor promotes cutaneous wound healing by affecting keratinocyte intercellular adhesion and Migration. British Journal of Pharmacology. 2014 Jul;172(2):501–14. doi:10.1111/bph.12687

V. Bracken-Clarke D, Kapoor D, Baird AM, Buchanan PJ, Gately K, Cuffe S, et al. Vaping and lung cancer – a review of current data and recommendations. Lung Cancer. 2021 Mar;153:11–20. doi:10.1016/j.lungcan.2020.12.030

VI. Alvarenga MB, Francisco AA, Oliveira SM, Silva FM, Shimoda GT, Damiani LP. Episiotomy healing assessment: Redness, oedema, ecchymosis, Discharge, approximation (reeda) scale reliability. Revista Latino-Americana de Enfermagem. 2015 Feb;23(1):162–8. doi:10.1590/0104-1169.3633.2538

VII. Purba. J.T & Manalu B. 2020. Percepatan Penyembuhan Luka Post Operasi Sectio Caesarea Dengan Konsumsi Ikan Gabus (Channa Striata) Di Rumah Sakit Grandmed Lubuk Pakam Deli Serdang. Jurnal Doppler. 4 (2)

VIII. Sørensen LT. Wound healing and infection in surgery. Archives of Surgery. 2012 Apr 1;147(4):373. doi:10.1001/archsurg.2012.5

IX. Palmer AM, Brandon TH. How do electronic cigarettes affect cravings to smoke or vape? parsing the influences of nicotine and expectancies using the balanced-placebo design. Journal of Consulting and Clinical Psychology. 2018 May;86(5):486–91. doi:10.1037/ccp0000303

X. Overbeek DL, Kass AP, Chiel LE, Boyer EW, Casey AM. A review of toxic effects of electronic cigarettes/vaping in adolescents and young adults.

Critical Reviews in Toxicology. 2020 Jul 2;50(6):531–8. doi:10.1080/10408444.2020.1794443

XI. Ashour O, Al-Huneidy L, Noordeen H. The implications of vaping on surgical wound healing: A systematic review. Surgery. 2023 Jun;173(6):1452–62. doi:10.1016/j.surg.2023.02.017

XII. Landman ST, Dhaliwal I, Mackenzie CA, Martinu T, Steel A, Bosma KJ. Life-threatening bronchiolitis related to electronic cigarette use in a Canadian youth. Canadian Medical Association Journal. 2019 Nov 20;191(48). doi:10.1503/cmaj.191402

XIII. Ferreira MC, Tuma P, Carvalho VF, Kamamoto F. Complex wounds. Clinics. 2006;61(6):571–8. doi:10.1590/s1807-59322006000600014