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Critical Review on *Dhamani Sharir* Wsr to *Sushruta Samhita*

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Abstract: ***The cardiovascular system is an important life-sustaining and nourishing system in the human body. The terms Hridaya, Siras, and Dhamanis are as old as the Vedas. They have generally been used in the context of the Ayurvedic cardiovascular system.Siras and Dhamanis emerge from the Nabhi (umbilicus), spread throughout the body, and constantly supply air to the dhatus.Ayurvedic acharyas have used the anatomical term Dhamani, which is one of the contentious terms (structure). The main problem is that every writer on the subject approaches the problem with preconceived ideas and tries to read his own views into the ancient texts, which always leads to confusion.Dhamanis (arteries) transport rasadhatu throughout the body, filling it with air. Dhamanis pointed out the ducts with thick walls and siras those with thin walls.The concept behind the origin of siras from nabhi also supports the origin of dhamanis from nabhi, i.e. the time period in which embryos form in the uterus is also the time period in which dhamanis form.***

Keywords: Ayurveda; dhamani; sushruta; artery; Cardiovascular system; Nourishing system; Human body; Hridaya; Ayurvedic; Anatomy; hridayashrita; Physiology; Lymphatic vessels; Inspiration; Sighing; Yawning; Sneezing; Laughter; Speech; Weeping; Urine; Umbilical veins; Hridaya

I. INTRODUCTION

Ancient acharyas advocated thorough structural scientific knowledge of life. *Rachana Sharira* knowledge is required for all medical students. Because of the description available in *Sushrutasamhita* regarding methodology for learning anatomy, dissection on cadaver, *dhamani, sira, marma*, and so on, *Acharya Sushruta* has been referred to as the father of surgery. He has prioritized practical knowledge. *Dhamani* words are used in many references in the *Sushrutasamhita*, including *moola* of *srotasas, nabhinadi, hridayashrita*, and various diseases.

The classification of *siras, dhamanis*, and s*rotas,* the channels, passages, and ducts in the body, including the arteries, veins, nerves, and lymphatic vessels, has long been a source of consternation in Indian anatomy and physiology. The ancient medical writers themselves recognized the difficulty. All subsequent attempts to solve this puzzle have only added to the confusion. The *dhamanis'* functions differ as well.Sound, touch, taste, sight, smell, inspiration, sighing, yawning, sneezing, laughter, speech, weeping, and other bodily functions are performed by the ascending *dhamanis* performers and help to keep the body's integrity. The down-coursing *dhamanis* serve as channels for the downward conveyance of *vayu*, urine, stool, sperm, and contaminated fluids'. According to the enumeration of their functions above, *dhamanis* stand for nerves and ducts. However, a critical examination of the cardinal features of *dhamani* reveals that it should only be an artery and no other anatomical structures. A critical comparison of the detailed list of *siras* and *dhamanis* will reveal that no ducts, no specific nerves except the *vata* vessels, and no *rasa* carrying vessels are mentioned in the list of *siras.*

Dhamanis carry rasa throughout the body and fill it with air. It is significant that rasa conveyance is restricted to *dhamanis* only[1,2]. *Rasa* is the byproduct of food digestion. It is converted into *rakta* in the liver and spleen, but the heart is its primary receptacle. The Indian physiologist's arterial blood is the blood that leaves the liver and spleen. The systematic arteries are distributed in the form of a highly ramified tree, the common trunk of which is formed by the aorta and begins at the left ventricle, while the smallest ramifications extend to the peripheral parts of the body and the contained organs. Arteries are found throughout the body, with the exception of the hairs, nails, epidermis, cartilages, and cornea.

Larger trunks typically occupy the most protected environments, running in the limbs along the flexor surface, where they are less vulnerable to injury. The mode of division of the arteries varies greatly: occasionally a short trunk subdivides into several branches at the same point, as seen in the celiac artery and the thyrocervical trunk; the vessel may give off several branches in succession and still continue as the main trunk, as seen in the limb arteries; or the division may be dichotomous, as seen when the aorta divides into the two common iliacs.[3]

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II. DEVELOPMENT AND DIVISION OF DHAMANI

There are ten *Dhamani* (arteries) arising from the *nabhi* (umbilicus), ten downward, and four sideward (transverse). The direction of vessels around the umbilicus has been described by *Sushruta*, but it is not clear which vessels these are or what their true names are because we have not accepted *Sushruta's* theory regarding the origin of vessels from the umbilicus. *Sushruta* used the term "*Nabhiprabhava"* only because vessels such as umbilical arteries and veins begin from the fetal umbilicus during intrauterine life. As a result, one can accept this statement in relation to fetal life. The second point of view is that the word *nabhi* might have been used in the sense of heart. Even if this is true, the use of the word "nabhi" is also justified. However, before labeling "nabhi" fore heart, it should be determined whether this can be proven scientifically or not. Even in charak, astangasangraha, and astangahridaya, the term nabhi has been used to refer to fetal life. Sushruta himself has changed his mind about the origin of dhamanis from nabhi (umbilicus) to hridaya (heart) in sutrasthan"sonitavarniyaadhyaya"[4,5].

Blood vessels first appear in several scattered vascular areas that develop simultaneously between the endoderm and mesoderm of the yolk sac, i.e., outside the embryo's body. A new type of cell, the angioblastor vasoformative cell, has emerged from the mesoderm[6]. In the 30th chapter of the *Sutrasthan, Charaka* also mentions that the *dhamanis* (arteries) arise from the *hridaya* (heart)[7]. According to *Acharya Susruta*, we will now describe the characteristics of the foetus' derivations from the father, mother, rasa *dhatu* (plasma), a*tma* (soul), *satva* (mind), and *satmya* (habituation). The stable *kesha* (head hair), *samashru* (mustaches) and *roma* (body hairs), *asthi* (bone), *nakha* (nails), *danta* (teeth), *sira* (veins), *snayu* (ligaments), *dhamanis* (arteries), and *shukra* (semen) are derived from the *pitrija* (father). The essence of *shonita* (blood) and *kapha*[8,9] produce *hridaya* (heart) and the *pranavahadhamani* (arteries sustaining respiration and life) attached to it. As a result, it is safe to say that *Sushruta* had a clear idea in his mind that *dhamanis* are the vessels that originate from the *nabhi* (umbilicus) only during fetal life and are directly related to the *hridaya* (heart) after birth. Concerning the confusion between *dhamani*, *sira*, and *srotas*, he himself has stated that this confusion is solely due to the close anatomical relationship between *dhamani*, *sira*, and *srotas.*

III. URDHWAGADHAMANI (DHAMANI OF HEAD AND NECK REGION)

Those spreading upward, support (maintain) the body by attending to functions such as receiving sensation of *shabda* (sound), *sparsha* (touch), *rupa* (sight), *rasa* (taste) and *gandha (smell); praswas (inspiration), ucchwas (expiration), jrimbha (yawning), kshavathu* (sneezing), *hasita* (laughing), *kathita* (talking), *ghosita* (shouting) and such other functions. After reaching the *hridaya* (heart), each one divides into three, yielding thirty. Two of these carry *vata*, *pitta*, *kapha*, *shonita*, and *rasa*, for a total of ten. Two carry the sensations of *shabda* (sound), *rupa* (sight), *rasa* (taste), and *gandha* (smell), for a total of eight. Two attend to *kathita* (speaking in words), two to *ghosita* (shouting or loud sound without words), two to *swapiti* (sleep), and two to *pratibudhi* (waking), two carry *ashru* (tears in the eyes), two carry *stanya* (breast milk) in women's breasts, and these only carry *shukra* (semen) from men's breasts-thus twelve. Thus, the divisions of the thirty *urdhvagadhamanis* describe the total of thirty *urdhvagadhamanis.* The abdomen, flanks, back, chest, shoulders, neck, arms, and other parts of the body above the umbilicus are supported and maintained by these *(dhamani).*

All of these functions are always performed by the upward *dhamani* (during one's life).*Dr.ghanekarand gangadher shastri* has both submitted statements in response to the preceding couplet[10]. *Pandit Gangadher Shastri* has classified all of these *dhamani* as nerves in the order listed below. *Sabdavahadhamani* (auditory nerves), *rupavahadhamani* (optic nerves), *rasavahadhamani* (taste nerves), *gandhvahadhamani* (olfactory nerves), *bhasandhamani* (inferior laryngeal nerves), ghosakardhamani (hypoglossal nerves), and *ashruvahadhamani* (lacrimal nerves). *Dr. Ghanekar* preferred to call some of these vessels internal auditory arteries for *sabdavahadhamani* (voice carrying vessels), central retinal arteries for *rupavahadhamani* (vision), lingual arteries for *rasavahadhamani* (sense of taste), sphenopalatine branch of internal maxillary arteries for g*andhvahadhamani* (the sense of smell), laryngeal arteries for *ghosakardhamani* (the sense *Urdhwaga dhamani's* modern correlation is given below.

1) *Sabdavahadhamani*- Internal auditory artery (acoustic nerve)
2) *Rupavahadhamani*- Central retinal artery (optic nerve)
3) *Rasavahadhamani*- Lingual artery (nerves of taste that is branches from glossopharyngeal and lingual)
4) *Gandhavahadhamani*-Sphinopalatine branch of the internal maxillary artery (olfactory nerve)
5) *Ghosakardhamani*- Laryngeal arteries (inferior laryngeal nerve)
6) *Bhasandhamani*- Sublingual artery (hypoglossal nerve)
7) *Ashruvahidhamani*- Lacrimal artery (lacrimal nerve)
8) *Stanyavahidhamani*- Mammary artery

Breast milk is produced after the *dhamani* (arteries) present in the (region of) the heart (the breasts) open after three or four days (after the child's birth). Some *urdhwaga dhamanis* are associated with respiratory movement, which involves the diaphragm and other muscles. As a result, the blood vessels that supply these muscles, namely the phrenic and intercostal arteries (phrenic nerve), are included in these. Except for these local arteries, the brain controls all other functions.

The two common carotid arteries supply the head and neck; they ascend in the neck and divide into two branches, namely, (1) the external carotid, which supplies the exterior of the head, face, and the majority of the neck; (2) the internal carotid, which supplies the cranial and orbital cavities to a large extent.As a result, *urdhvagadhamanis* are linked to all arteries and their branches that supply the head, neck, brain, upper limbs, and thorax.[11]

IV. ADHOGADHAMANI (DHAMANI OF ABDOMEN AND PELVIC REGION)

Dhamani (arteries) spreading downward purvey flatus, feces, sperm, and menstrual blood, among other things. When these reach the pittasaya, they separate the essence of foods and drinks (known as *rasa dhatu*) produced by heat into *sara* (essence) and *kitta* (waste). Purveys it throughout the body and nourishes the body by supplying nutrient materials present in food essence, supplies it to the *dhamani* spreading in an upward and transverse direction, fills the seat of *rasa (hridaya*), and separates urine, feces, and sweat (from the *rasa*). Each of these (*dhamanis)* divides into three branches between the a*mashaya* (stomach) and the *pakvashaya* (colon), totaling thirty. Two of these carry vata, pitta, kapha, sonita, and rasathus ten. Two in the intestine purvey *anna*, two carry *toya* (water produced during digestion), two in the bladder carry urine, two are meant for *shukra* production in the testes and two for its elimination, these only purvey and eliminate the blood known as *artava* in women; two attached to the large intestine are for expelling the faces- thus twelve. Another eight *dhamani* supply sweat to those (*dhamani*) spreading transversely, completing the description of the thirty branches.

These (*dhamani*) support and maintain the parts of the body below the umbilicus such as *pakwashaya* (large intestines*), kati* (pelvis), *mutrashaya* (urinary bladder*), purishashaya* (feces organs i.e. rectum), *guda* (anus), *vasti* (bladder), *medhr*a (penis), and *sakthi* (legs). *Dhamani* spreading downward performs these functions continuously (for the rest of one's life). *Adhogami dhamanis* are associated with the abdomen and lower limbs. *Vata, mutra, purish*, and *sukraandartava* are formed (created) in the abdomen and move downwards[12]. After receiving blood supply from their arteries, these substances form in their respective organs and then move downward to exit the body.*Adhogami dhamani* descends into *amashaya* and *pittashay*a. This is *pittadhara kala's* location. Food is digested and absorbed in this area to form *annarasha,* which properly nourishes the body. These intestine functions (digestion and absorption) are only possible when *adhogamidhamanis* supply blood to the intestine. As a result, this *dhamani* is known as *vivechak* (difference) and *abhivahak* (supplier).

Ingestible food is digested by *adhogamidhamanis* to form *rasa*, which moves upward to reach the heart via *siras* (veins) and *rasayanis* (lymphatic vessels) to nourish the *urdhvagaandtiryagadhamanis.* It means that the *adhogamidhamanis* indirectly nourishes the *urdhvagadhamanis. Satmya* part of the digested food is absorbed by *rasa prapa* (cisterna chili) and *rasa kulya* (thoracic duct) to be carried in the heart. *Mutra* (urine)*, purisha* (feces), and *sweda* (sweat) are examples of *malas* of *pakwa anna* (digested food). These *malas* are distinguished in the *udarvibhag* (abdominal region). S*wedasravan* (sweating) is a function of t*iryaggami dhamani*, but *adhogamidhamani* is in charge of blood supply to *tiryaggami dhamani.* Each *adhogamidhamani* is divided into three branches between the a*mashay*a and

pakwashaya spaces. The arteries that supply *amashaya* and *chhudrantra* are capable of moving digested food downward, namely the celiac artery and superior mesenteric artery (vagi and sympathetic nerves).

1) *Mutravahidhamani*: The artery that supplies blood to the organ that produces urine. The main site of urine in *Ayurveda* is the *basti* (urinary bladder). In this context, vesical arteries are referred to as *mutravahi dhamani*. According to K*avirajgananathsen, gavini* (ureter) is appropriate for *mutravahidhamani.* But, according to modern science, renal arteries (nerves from the renal plexus, spermatic plexus, ovarian, inferior mesenteric plexus, and hypogastric plexus) are *mutravahidhamani.*
2) *Shukravahidhamani*: *Shukravahidhaman*i refers to the arteries that supply blood to the sperm-producing organ, which include the testicular and spermatic arteries (spermatic plexus).
3) *Shukra-visharjinidhamani*: During *maithun* (coitus), sperm from the testis travels to the epididymis, vas deference, and prostate. Sperm ejaculation occurs as a result of urethral contraction. *Shukravisharjinidhamani* are arteries that supply the epididymis, vas deferens, and prostate in this context.
4) *Varchonirashnidhamani*: The large intestine's function is to move fecal matter downward and defecate it outside the body. As a result, the arteries that aid in this function are known as *varcho-nirashnidhamani*, which includes the inferior mesenteric artery, the middle colic artery, and the right colic artery (pelvic visceral nerve).

By supplying blood to the abdominal organ through its branches, these thirty *adhogamidhamani* nourish and support it [13].

The abdominal aorta begins in front of the lower border of the body of the last thoracic vertebra, descends in front of the vertebral column, and ends on the body of the fourth lumbar vertebra, commonly a little to the left of the middle line, by dividing into the two common iliac arteries. The anastomoses between the internal mammary and the inferior epigastric would continue the collateral circulation, as would free communication between the superior and inferior mesenterics if the ligature was placed between these vessels. or by anastomosis between the inferior mesenteric and the internal pudendal when the point of ligature is below the origin of the inferior mesenteric, as is more common; and possibly by anastomosis of the lumbar arteries with hypogastric branches.The abdominal aorta branches are classified into three types: visceral, parietal, and terminal.

Visceral branches include celiac, superior mesenteric, inferior mesenteric, middle supra-renals,renals,internal spermatics, and ovarian (in females). Parietal branches include the inferior phrenic, lumbar, and middle sacral arteries. Terminal branches are iliac arteries.The celiac artery and the superior and inferior mesenteric arteries are unpaired among the visceral branches, whereas the suprarenals, renals, internal spermatics, and ovarian arteries are. The inferior phrenic and lumbar parietal branches are paired, while the middle sacral is unpaired. The terminal branches are paired16. In modern anatomy, the abdominal aorta and its branches are referred to as *adhogamidhamanis*. There is no description of any special function performed by arteries in the lower limb. As a result, arteries in the lower limbs are not described in this context; their names are given as *swedamarpayanti*[14].

V. TIRYAGGAMI DHAMANIS (DHAMANI OF CUTANEOUS REGION)

Each of the four dhamanispreading sideward divides into hundreds and thousands of additional branches, becoming innumerable.The entire body appears gavaksita (full of windows) by these; these knit together broadly, their mouths (openings) are attached to the romakupa (hair follicles), and these purvey sweda (sweat to the outside) and rasa (chyme/nutrient tissue) both inside and outside.Only the potency (effect) of materials (medicines) used in abhyanga (anointing), parisheka (pouring liquids on the body), and lepa (application of pastes) gets cooked (processed by heat) in the skin and enters the interior of the body through these. Only these perceive (understand) the sensations of touch, both pleasant and unpleasant[15]. First, determine which arteries are the lateral coursing *dhamanis.* Lateral coursing is also known as cutaneous arteries, which supply the skin or travel to the sides of the body.

Upper coursing refers to the nerves that supply the head, neck, upper limbs, and thorax. Lower coursing refers to those that supply the abdomen and lower limbs. *Sushruta* was unable to identify the four arteries that are directed laterally.However, there is a direct indication of four d*hamanis* that devides to become thousands, and the arteries of the upper and lower limbs are not described here. As a result, we can accept four *tiryaggami dhamanis* as cutaneous vessels of four limbs[16]. The *Urdhvagami dhamanis* are associated with the head, neck, brain, thorax, and upper limbs. *Adhogami dhamanis* are associated with the abdominal organs and the lower limbs. *Tiryaggami dhamanis* are associated with the skin's outer surface. *Tiryaggamidhamanis* are known as cutaneous or peripheral vessels in modern science.

VI. CONCLUSION

The apparent similarity between *dhamani* and nerve functions is due to the fact that these functions are interdependent and supplementary to one another. Nerve functions will be ineffective in any part of the body unless it is supplied with blood via the arteries. Regarding the origin and division of *dhamani*, it is safe to say that *Sushruta* had a clear idea in his mind that *dhamanis* are the vessels that originate from *nabhi* only during fetal life and are directly related to the *hridaya* after birth.In terms of twenty-four numbers, cardinal veins, vitelline plexuses, umbilical veins, and umbilical arteries can be seen in this area during intrauterine life.As a result, the statement of twenty-four *dhamani* (vessels) arising from the nabhi (umbilicus) appears to be speculative.

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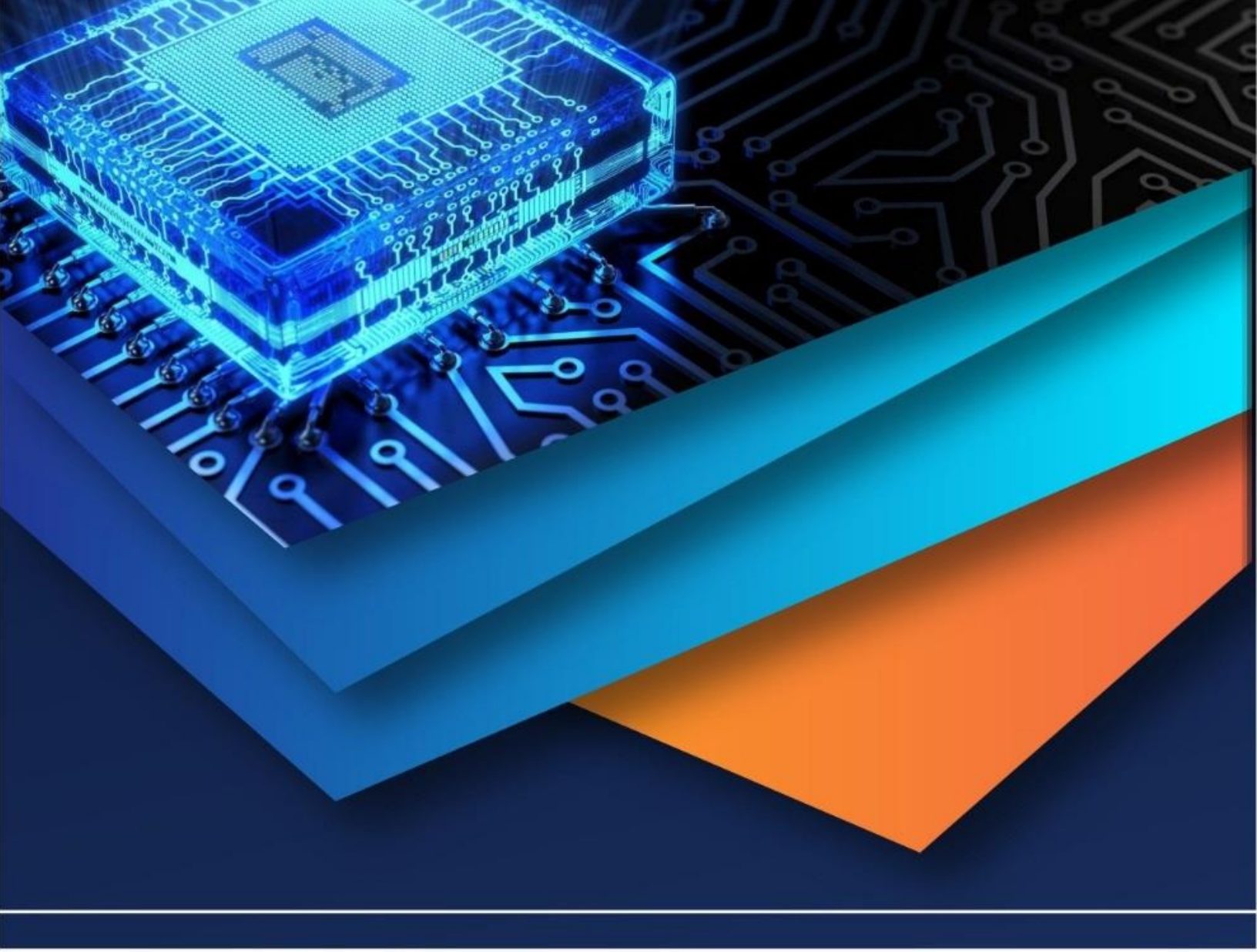

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