NEURO-ANATOMICAL EXPLANATION OF THE MODE OF ACTION OF AGNI KARMA IN PAIN MANAGEMENT OF MUSCULOSKELETAL DISORDERS
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KEYWORDS: Agni Karma, parasurgical procedure, Neuro-anatomical explanation.

INTRODUCTION
Agni Karma is a para-surgical procedure, which has been advocated for the treatment of various Vatika and Vata-Kaphaja disorders in the literature. Agni Karma word is formed by the combination of two words Agni and Karma which means the Karma accomplished by the application of Agni (heat). In Sushruta Samhita the most ancient text book of Shalya Tantra a complete chapter has been devoted for the description of this important procedure. This emphasizes the importance of that treatment in Shalya Tantra. According to Acharya Sushruta "The procedure in which the Samyaka Dagdha Vrana is produced by Agni is called the Agni Karma. It is frequently indicated in many musculoskeletal disorders like pain. Pain is a vital function of the nervous system in providing the body with a warning of potential or actual injury. Noceptors are the free nerve endings of primary afferent A δ and C fibres. A δ and C fibres synapse with secondary afferent neurones in the dorsal horn of the spinal cord. Glycine and gamma-aminobutyric acid (GABA) are important neurotransmitters acting at inhibitory interneurons. The spinothalamic tract and the spinoreticular tract are the two main pathways that carry nociceptive signals to higher centres in the brain. On the basis of Ayurvedic Classics pain is caused by vitiated Vata Dosha and Agni Karma counter acts on it due to its Ushna Guna, as it is exactly opposite to Sheetaguna of Vata. This is supported by quotation of Yajurveda "Agni Himasya Bhaishja".

ABSTRACT
AgniKarma is a para-surgical procedure, Agni and Karma which means the Karma accomplished by the application of Agni (heat). According to Acharya Sushruta "The procedure in which the Samyaka Dagdha Vrana is produced by Agni is called the Agni Karma. It is frequently indicated in many musculoskeletal disorders like pain. Pain is a vital function of the nervous system in providing the body with a warning of potential or actual injury. Noceptors are the free nerve endings of primary afferent A δ and C fibres. A δ and C fibres synapse with secondary afferent neurones in the dorsal horn of the spinal cord. Glycine and gamma-aminobutyric acid (GABA) are important neurotransmitters acting at inhibitory interneurons. The spinothalamic tract and the spinoreticular tract are the two main pathways that carry nociceptive signals to higher centres in the brain. On the basis of Ayurvedic Classics pain is caused by vitiated Vata Dosha and Agni Karma counter acts on it due to its Ushna Guna, as it is exactly opposite to Sheetaguna of Vata. This is supported by quotation of Yajurveda "Agni Himasya Bhaishja".

Review of Ayurvedic literature about the Agni Karma Procedure of Agni Karma
Agni Karma is a para surgical measure and requires all the principles to be observed carefully which are mentioned in ancient Ayurvedic texts.

Purva Karma (Pre-operative preparation)
- Patient and attendants should counselled and explained about the procedure in order to make them mentally aware about the procedure. Because Agni Karma being a pain full therapeutic procedure can create a fear or anxiety in the patient.
- Agropharaniya- Before starting the procedure, a Panchdhatu Salaka, artery forceps, sponge holding forceps, gauge piece, cotton, Gritkumari pulp, Murchhit Til-Tail, adhesive tape, cotton bandage etc. all should kept ready.
- Most tender spot should thoroughly cleansed and gentle Abhyanga should done with Murchhit Til-Tail for 10 minutes in the direction of hairs. This served the purpose of both Snehana and Svedana, as Til-Tail provides Snehana and Abhyanga is a variety of Anagni Swedana mentioned by Acharya Charaka.
- Patient was advised to take some Pichhila (unctuous) diet.
**Pradhana Karma (Main procedure)**

Patient was kept in suitable position before starting the procedure. Then the Panchdhatu Salaka should be heated up to red-hot and Bindu type Dagdhas were made on the most tender spot of the painful area, till the Samyaka Twaka Dagdha Lakshana occur i.e. Shabdapradurbhava, Durgandhata. During the procedure patient kept being consoled and held comfortably by the assistants. In case patient get frighten or not co-operate the procedure so stop the procedure immediately.

**Paschata Karma (Post-operative measures)**

Immediately after completion of the procedure Gritkumari pulp should apply over the Vrana and gauge impregnated with Madhuyastichurna kept and bandaged. Patient should advise to take rest for about 10 minutes on the operation table and not to get up promptly just after the completion of the procedure.

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**Review of neuro-anatomy related to pain and pain relief**

**Neuro-anatomy of Pain Pathways**

Pain is a vital function of the nervous system in providing the body with a warning of potential or actual injury.

**Nociceptors**

Nociceptors are the specialised sensory receptors responsible for the detection of noxious (unpleasant) stimuli, transforming the stimuli into electrical signals, which are then conducted to the central nervous system. They are the free nerve endings of primary afferent A\(\delta\) and C fibres. Distributed throughout the body (skin, viscera, muscles, joints, meninges) they can be stimulated by mechanical, thermal or chemical stimuli.

**Primary afferent fibres**

In addition to the A\(\delta\) and C fibres that carry noxious sensory information, there are primary afferent A\(\beta\) fibres that carry non-noxious stimuli. Each of these fibre types possesses different characteristics that allow the transmission of particular types of sensory information.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>A(\beta) fibres</th>
<th>A(\delta) fibres</th>
<th>C fibres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myelination</td>
<td>Highly</td>
<td>Thinly</td>
<td>Unmyelinated</td>
</tr>
<tr>
<td>Conduction Velocity</td>
<td>&gt;40 ms(^{-1})</td>
<td>5-15 ms(^{-1})</td>
<td>&lt;2 ms(^{-1})</td>
</tr>
<tr>
<td>Receptor activation threshold</td>
<td>Low</td>
<td>High and low</td>
<td>High</td>
</tr>
<tr>
<td>Sensation on stimulation</td>
<td>Light, touch, non-noxious</td>
<td>Rapid, Sharp, Localised Pain</td>
<td>Slow, defused, dull pain</td>
</tr>
</tbody>
</table>

**Ascending tracts in the spinal cord**

There are two main pathways that carry nociceptive signals to higher centres in the brain.

- **The spinothalamic tract:** secondary afferent neurones decussate within a few segments of the level of entry into the spinal cord and ascend in the contra lateral spinothalamic tract to nuclei within the thalamus. Third order neurones then ascend to terminate in the somatosensory cortex. There are also projections to the periaqueductal grey matter (PAG). The spinothalamic tract transmits signals that are important for pain localisation.

- **The spinoreticular tract:** fibres also decussate and ascend the contralateral cord to reach the brainstem reticular formation, before projecting to the thalamus and hypothalamus. There are many further projections to the cortex. This pathway is involved in the emotional aspects of pain.

**Figure 1. Showing Motor and Sensory Pathways**
Discussion

Probable Mode of action of Agni Karma

The probable mode of action of Agni Karma can be explained on the following basis:

1. Ayurvedic Basis

Pain is caused by vitiated Vata Dosha and Agni Karma counter acts on it due to its Ushna Guna, as it is exactly opposite to Sheetaguna of Vata. This is supported by quotation of Yajurveda "Agni Himasya Bhaishja".

2. Modern Basis

Inhibition of pain transmission

Intensity of injury may remain same, but different persons or the same person at different times may feel the pain differently. This is because our body has endogenous pain inhibiting system. If this system is over active, pain perception may be abolished altogether. The endogenous pain inhibiting system consist of

1. Gate control mechanism.
2. Descending pain inhibiting system.

1. Gate control theory of pain

The gate control theory of pain was proposed by Melzack and Wall in 1965 to describe a process of inhibitory pain modulation at the spinal cord level. When the painful stimulus alone is applied the pain is more intensely felt than the stimulus of same intensity is applied concomitantly with the tactile stimulus e.g. application of heat in the form of Agni Karma, in this case.

Let a painful stimulation be applied in the periphery, the pain is carried by primary afferent which terminates in substantia gelatinoa Rolando. From here second order neurons emerges to constitute spinothalamic tract.

Also, tract of Goll and Burdach (lemniscal fibres) carrying tactile sense (coming from periphery) passes through the dorsal column remaining close to the Substancia Gelatinoa Rolando. While the tract of Goll and Burdach ascend upwards, it gives collaterals to the termination of primary pain carrying afferent at SGR. When a tactile sensory stimulus is applied in the periphery, the tract of Goll and burdach is stimulated and via the collateral mentioned above it effect presynaptic inhibition on the primary pain carrying afferent and pain sensation is inhibited.

2. Descending pain inhibiting system

- PAG (periaqueductal gray) is an area round the aqueduct of Sylvius in the mid brain. From PAG a bunch of descending fibres arise which relays in magnus raphe nucleus (situated in the middle at the junction of pons and medulla). Next order neurons terminates at SGR (substantia gelatinosa Ronaldo situated at the tip of posterior horn of the spinal cord). This is descending pain inhibiting pathway.
- The first order neuron, which carries pain from the periphery is terminates at substantia gelatinosarolando. From SGR the second order neuron emerges and constitutes the lateral STT (spinothalamic tract) to terminate in the thalamus. The neurotransmitter (NT) at the synapse between terminal part of APC and beginning of STT is substance P.

When descending pain inhibiting system is stimulated the terminal part of descending pain inhibitory fibres release some endogenous opioid peptides as neurotransmitter at SGR. These endogenous opioid peptides cause inhibition of substance P, leading to transmission blockade of pain sensation, hence no pain is felt.

Descending pain inhibitory fibres are stimulated with the stimulation of limbic system and with the mechanism of auto feedback i.e. when spinothalamic tract is stimulated collaterals from spinothalamic tract can stimulate the descending pain inhibiting system. On Agni Karma the lateral spinothalamic tract get stimulated as this is concerned with the transmission of temperature sensations and this in turn stimulates descending pain inhibition system.

Anatomy, physiology and pharmacology of pain by MacIntyre PE& others

An introduction to pain pathways and mechanisms by Dr Danielle Reddi
CONCLUSION

Agni Karma is a procedure frequently indicated in many Vata and Kapha predominant conditions. It is very effective procedure for pain management by inhibiting the pain pathways. By knowing the mode of action of Agni Karma it is possible to use it in many unexplained musculoskeletal problems more effectively.

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Cite this article as:

Source of support: Nil, Conflict of interest: None Declared