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# The Back Burns and the Hands Feel Cold: Reconstructing Cold–Heat from a Single Score into a Spatiotemporal Phenotype

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## Abstract

When one person reports heat in the back and a deep chill in the hands at the same time, placing the experience on a single “cold or heat” axis erases its most clinically informative features: distribution and simultaneity. Replacing that experience with one thermographic image erases sensory coding, temporal delay, adaptation, and context. This problem-led critical synthesis reads Korean-medicine cold–heat questionnaires; Korean and Japanese work on cold hypersensitivity; thermosensory physiology; quantitative sensory testing; vascular provocation; objective–subjective discordance in hot flushes; neuropathic burning; and the regional, depth, and temporal distinctions preserved in the Donguibogam. Three recurrent reductions emerge: spatial reduction of whole-body cold–heat into a sum score; temporal reduction of a fluctuating event to resting skin temperature; and criterion circularity when groups defined by expert judgment or self-report are reclassified using closely related questions or images. We propose a “local thermal field” that records, for location l and time t, perceived quality and intensity P(l,t), skin temperature and its rate of change T(l,t), cold and warm detection Q(l,t), perfusion and rewarming V(l,t), provoking and relieving context C(t), and functional effect F(t). This is not a new diagnosis but a measurement grammar for separating competing explanations. The first study should not train an AI to guess disease or test treatment effectiveness. It should combine cognitive interviews, 14-day event-based body maps, ambient temperature, and standardized rest–provocation–recovery observations to test repeatability, added information, and feasibility. The contribution of Korean-medicine observation is not to replace biomedical measurement, but to preserve experiences in which different regions move in different directions and to make any added prognostic, functional, or treatment-selection value falsifiable.


**Keywords:** localized thermal sensation · spatiotemporal phenotype · cold hypersensitivity of hands and feet · thermoception · thermography · cold–heat pattern identification · critical synthesis

# When cold and heat occur in the same person

“One side of my back feels as if it faces a fire, while my hands feel chilled from within.” Translating this sentence into either a whole-body cold pattern or heat pattern deletes two facts: the location is not simply the back but one side of it, and the heat and cold coexist within the same time window rather than alternating. The clinically useful question is not which sensation is real, but how sensations in different regions change together, in what sequence, and under which conditions.

“Chilled” may not mean merely cold. A patient may use it for cooling of the skin, cold felt deep in bone, tingling, pain, numbness, or the sense of a draught passing through the limb. “Hot” may cross objective warming, flushing, burning pain, itch, and oppressive heat. Words must not be converted immediately into mechanisms, but neither should their sensory quality be discarded. This two-sided boundary is the starting point of the study.

# What kind of paper does this question require?

This is not a systematic review because it does not estimate the average effect of an intervention. Nor is it a diagnostic paper that validates traditional categories such as heat on the back or cold extremities as modern diseases. The prior question is whether current cold–heat language and measurement

preserve localized, mixed complaints. Answering it requires a problem-led critical synthesis: conceptual history, measurement construction, and counterexamples from distinct clinical states are compared to derive observations that can separate explanations.

PubMed, PMC, KCI, J-STAGE, and the public Korean Institute of Oriental Medicine corpus were searched on 13 August 2026. Sources were grouped into seven families: cold–heat questionnaires and expert consensus; Korean and Japanese cold-hypersensitivity research; thermosensory physiology and QST; vascular provocation and thermography; objective–subjective discordance; clinical counterexamples involving focal burning or cold; and East Asian primary texts. Priority was given to sources capable of changing a central claim, including studies that expose measurement failure or narrow applicability. This is not a completed exhaustive review; search strings and inclusion decisions are released in a separate ledger.

## What is lost when cold–heat becomes one score

A shortened Korean-medicine cold–heat questionnaire reviewed domains including the whole body, body parts, fluid preference, excretion, sensation, and emotion before compressing them into seven items. In 1,759 retested participants, the correlation was 0.609; agreement with practitioner classification was 74.5%, with kappa 0.487 [1]. The instrument matters because it provides a brief, repeatable common language. Yet moderate agreement should be a starting point for asking what different clinicians read differently, not an endpoint declaring cold–heat fully measured.

In a survey of 31 experts at university-affiliated Korean-medicine hospitals, 77.4% considered subjective symptoms more important than instrumental findings, whereas only 32.2% and 35.5% accepted proposed proximal–distal skin-temperature criteria for hands and feet [2]. This suggests not that either subjective or objective measurement is wrong, but that they observe different targets. Criterion circularity arises when a cold–heat category defined by symptoms is validated against closely related questions or practitioner judgment. A whole-body score may be useful for screening and group comparison, but it lacks coordinates for simultaneous heat in the back and cold in the hands.

A Korean nationwide survey measured cold sensation separately in the hands, feet, and abdomen; the regions were highly correlated, yet 34.2% reported cold hypersensitivity in at least one site [3]. A 2026 scoping review identified 109 Korean and Japanese studies but still concluded that unified diagnostic criteria were needed [4]. A large literature does not imply a stable construct. The next task is not another yes-or-no classification of “cold hypersensitivity,” but an analysis of which distinct cold experiences prior studies placed under the same name.

## Did classical medicine treat cold–heat as a single axis?

The editorial architecture of the Donguibogam “Fire” chapter does not treat heat as one quantity. Separate entries distinguish depth by palpation (手按辨熱深淺), regions associated with viscera (審臟腑熱之部分), day from night (熱有晝夜之分), upper/middle/lower burner, and heat of the palms, soles, and

chest (五心熱) [24]. This does not validate the physiology asserted in each entry. It does establish a historical observational grammar that kept distribution, depth, and time distinct.

The “Heat on the Back” entry consists of one sentence—“背熱屬肺. 肺居上焦, 故熱應於背”—marked as derived from the Yixue Rumen [25]. It does not diagnose lung disease or prescribe treatment for a contemporary patient. It shows that heat on the back was an editorial unit placing a regional observation within a visceral and upper-burner explanatory network. Rather than fixing it as a modern independent disease, it is more productive to use it as a historical compression that prompts questions: is the back objectively warmer; is the sensation unilateral; is it cutaneous; and does it covary with sweating, breathing, posture, or meals?

The “Cold” chapter distinguishes cold limited to hands and feet from cold extending through all four limbs, explicitly parsing the scope of 厥 and 四逆 [26]. This does not license translation of those categories into modern vascular disease. It supplies a rule about extent within the word “cold.” Paradoxically, the classical table of contents may be more sensitive to localization than a modern short cold–heat score. That possibility should be judged not by reverence for the text but by whether the recovered distinctions reduce information loss in actual patient descriptions.

## Sensation is not a defective thermometer

Skin temperature and thermal sensation are related but not identical. Warm and cold detection thresholds vary by age and body site [5], and sensitivity differs within hands and feet by glabrous versus hairy skin and by precise location [6]. The DFNS QST protocol combines cold and warm detection, thermal pain, paradoxical heat, and mechanical modalities against site-, age-, and sex-specific reference values. This standardization is valuable, but some parameters have limited individual diagnostic utility because confidence limits approach the device range, and the results remain psychophysical judgments made by participants [7].

More fundamentally, perceived temperature is not a linear output of one sensory channel. Spatially interlacing innocuous warm and cool stimuli can produce a hotter, more unpleasant, or painful percept than either component. The thermal grill illusion shows that signal integration can generate a quality absent from the physical stimulus; population coding explains the experimental record better than a one-pathway–one-quality model [8, 9]. The illusion does not explain a patient’s spontaneous heat sensation. It does refute the inference that heat without hot skin is merely measurement error.

A thermoception task that compared actual peripheral temperature change with awareness of that change also found substantial individual variation [10]. Discordance therefore becomes an outcome to explain rather than noise to discard. A person who feels hotter at the same skin temperature and a person who fails to detect greater cooling may have opposite sensory problems.

## Discordance can arise in at least four places

First is temporal sampling mismatch. Comparing a 20-minute nocturnal heat episode with one afternoon thermogram measures different events. In hot-flush research, diaries and sternal skin conductance can agree closely in the laboratory but show lower concordance during ambulatory monitoring [11]. In one study, only 47% of objective events had a subjective counterpart and 56% of subjective events had an objective recording [12]. The first design task is to align event windows, not to crown either subjective or objective data as truth.

Second is mismatch between resting values and dynamics. In Raynaud research, reperfusion and rewarming after cold challenge provided repeatable outcomes beyond baseline temperature [13]. Conversely, among 296 people with CRPS, 44.3% had bilateral temperature differences of 1°C or less, and temperature difference was unrelated to symptom duration [14]. A normal resting value does not guarantee normal recovery after provocation, while one abnormal value is not specific to a disease.

Third is channel mismatch. Skin temperature measures a physical state; laser perfusion measures superficial flow; QST records perceptual judgments to stimuli; skin biopsy measures a structural density; and autonomic tests sample selected sweating or vascular responses. Expert reviews of small-fibre neuropathy emphasize that these measures are not interchangeable and must be combined according to clinical purpose [15, 16]. Fourth is mismatch in spatial integration and language: one test point cannot represent a field described as “the whole hand,” “inside the bone,” or “deep in the back.” Rather than choosing one cause prematurely, each competing model should first state what ought to be observed (Table 1).

**Table 1.** Competing models and observations that discriminate among them

| Competing model | Prediction if true | Finding that weakens it |
|---|---|---|
| **Vascular dynamics** | Provoked colour, perfusion, or rewarming abnormalities align with symptom events. | Vascular measures remain normal and unrelated across repeated events. |
| **Sensory gain or loss** | Thermal detection or pain profiles dissociate from resting skin temperature. | Site- and age-adjusted QST remains normal and unrelated to events. |
| **Event-sampling error** | Discordance shrinks when subjective and sensor windows are aligned. | The same discordance persists after precise temporal alignment. |
| **Spatial integration** | Regional configuration or adjacency alters perception beyond local temperature. | Local measurements alone adequately explain perception at each site. |
| **Global cold–heat trait** | The global score explains regional pattern and function; the field adds no information. | Repeatable local patterns and functional outcomes diverge within the same global score. |
| **Linguistic construction** | Descriptors and boundaries shift with interview framing more than physiology. | Within-person location, quality, and timing remain stable across phrasings. |

**Note.** Several models may be partly true at once. The table does not force one cause; it states which next observation should change the weight assigned to each explanation.

## How different conditions produce the same thermal word

Raynaud phenomenon may involve colour and flow changes after cold or emotional provocation with delayed rewarming. Erythromelalgia involves warmth- or exercise-triggered erythema, warmth, and burning pain; excessive cooling can itself damage tissue [17]. Both conditions recruit thermal words,

yet require different safety questions and provocation logic. The simple symmetry “cool heat, warm cold” fails against these counterexamples.

In 1,090 patients with somatosensory lesions, paradoxical heat during cooling occurred in 30% of the neuropathic group and 2% of healthy controls [18]. Small-fibre neuropathy, meanwhile, may present with burning, cold, dysaesthesia, and autonomic symptoms despite normal routine nerve-conduction studies [15, 16]. These findings do not mean heat on the back is neuropathy. They warn that the direction of a thermal word cannot identify the direction of pathway dysfunction.

Localized burning of the back supplies another counterexample. Notalgia paresthetica, with itch, tingling, or burning near the scapula, is discussed as a focal sensory neuropathy; proximity between imaging findings and the symptom region does not establish the palpated structure or cause [19]. Burning feet likewise crosses erythromelalgia, neuropathy, nutritional or endocrine problems, and skin disease [20]. The useful move is not to append a long differential list, but to state what else should be observed if each explanation is true.

## What Korean and Japanese cold-hypersensitivity research has not resolved

Korean and Japanese cold-hypersensitivity research has importantly made subjective cold a legitimate medical object. Hiesho studies link peripheral temperature to autonomic, lifestyle, and menstrual factors, while Korean work has developed thermography, heart-rate variability, cold challenge, and questionnaires [4, 21]. Yet when a “cold” group is first defined by an unstable questionnaire, subsequent physiological differences may reflect cold sensation, sex, body size, lifestyle, or sampling; the design cannot easily separate them.

A convolutional model classifying Hiesho from 5,612 thermograms obtained from 46 people illustrates a critical validation problem when image count greatly exceeds participant count [22]. If repeated images from one person enter both training and evaluation, the model may recognize individual imaging signatures rather than cold hypersensitivity. The public abstract is insufficient to adjudicate the actual split, so we do not label the result erroneous. We do require participant-level splitting, external validation, and prespecified failure criteria in BRC work.

The central gap is more specific than “insufficient objectification.” Few studies treat the conditions under which subjective and objective signals agree or diverge as the result itself, rather than forcing them into one diagnostic truth. Most report a cross-sectional group difference and rarely observe how regional sensation, temperature, and function couple and uncouple within one person over days. A longitudinal local thermal field can add precisely this missing information.

# The local thermal field: a measurement grammar, not a diagnosis

In compact form, the local thermal field is H(l,t) = {P,T,Q,V,C,F}, where l is body location and t is time. P records perceived quality and intensity; T skin temperature, asymmetry, and rate of change; Q cold/warm detection and pain thresholds; V colour, flow, and rewarming; C ambient temperature, clothing, posture, activity, meals, sleep, emotion, medication, and menstrual context; and F effects on sleep, concentration, work, walking, and hand use (Figure 1; Table 2). The notation does not claim a complete physiology. It is an index preventing non-interchangeable observations from being omitted.

Within this model, “sensation–temperature discordance” is not one abnormal score. Events can be concordant (P and T move together), sensation-dominant (P changes without T), unperceived (T changes without P), dynamic (resting values agree but V is delayed after provocation), or spatially mixed (P and T move in opposite directions across regions). One person may move between cells over time. The purpose is not to fix a person in a category but to decide what next measurement would separate explanations.

Existing cold–heat scores are not discarded. They remain higher-level variables for whole-body tendency and preference but do not overwrite the field. Two people with the same global score may differ in regional distribution and dynamics; two people with opposite global scores may share delayed hand rewarming. If such crossings occur, the field adds information. If they do not, the more complex model should be abandoned.

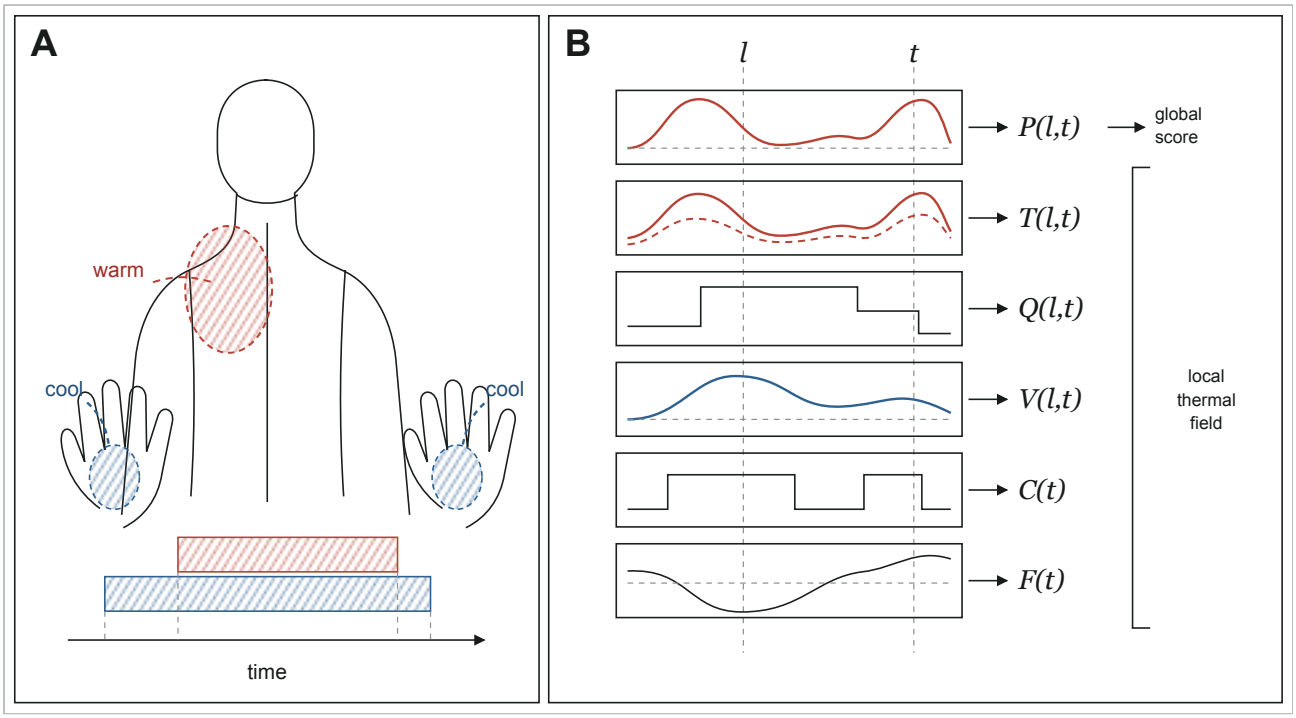


**Figure 1.** Conceptual model of the local thermal field. (A) Opposing sensations in different regions may coexist within the same time window. (B) A global sum score reduces perception to one value; the local thermal field separately records perception P, skin temperature and rate of change T, sensory thresholds Q, perfusion and rewarming V, context C, and function F for location l and time t.

Conceptual diagram; it displays neither observed data nor effect estimates. Produced by BRC with an AI image-generation tool and scientifically reviewed by the author.

**Table 2.** Components of the local thermal field and their non-interchangeable targets

| Term | Target | Possible observation | What it cannot establish alone |
|---|---|---|---|
| **P(l,t)** | Perceived quality, intensity, depth, boundary | Event report, body map, cognitive interview | Skin temperature or causal mechanism |
| **T(l,t)** | Skin temperature, asymmetry, rate of change | Contact sensor, standardized thermography | Perceived sensation or disease specificity |
| **Q(l,t)** | Cold/warm detection and pain thresholds | Site- and age-adjusted QST | Full temporal structure of spontaneous symptoms |
| **V(l,t)** | Colour, perfusion, post-provocation rewarming | Photograph, laser perfusion, rewarming curve | A vascular cause for every cold sensation |
| **C(t)** | Environment, posture, activity, meals, sleep, emotion, medication | Time-stamped diary and sensor metadata | Causality between context and symptom |
| **F(t)** | Sleep, concentration, work, walking, hand use | Patient-important functional outcome | Which physiological pathway changed function |

**Note.** l denotes body location and t time. Layers may be analysed together but are not treated as proxies for one another.

## Questions that must be answered inside the model

Good research does not maximize explanations; it organizes questions whose answers would change the next action. The most important internal questions are:

- Do cognitive interviews distinguish “chilled” from “cold” and “burning” from “hot,” or are these person-specific metaphors?
- How much do patient-drawn regions overlap across repeated recordings of the same event type?
- Does intensity covary most with absolute skin temperature, asymmetry, rate of change, or recovery after cooling?
- Do back heat and hand chill rise together, occur in sequence, or vary independently?
- Does the local field explain sleep, concentration, hand use, or walking beyond a global cold–heat score?
- Which combinations of colour change, swelling, pain, sensory loss, sweating, or orthostatic symptoms require a different clinical pathway?
- Do region, depth, and time questions derived from classical texts improve retest agreement or explanatory value beyond contemporary everyday language?
- What does it mean to patients when treatment changes sensation without temperature, or temperature without sensation?

## Hypotheses and conditions for abandoning them

Hypothesis 1 is that location and event type are more stable within a person than chance. If 14-day body-map overlap and within-person event agreement are low, “phenotype” should be withdrawn. Hypothesis 2 is that event-aligned rate of change and recovery curves correspond more closely to sensation and function than resting skin temperature. It fails if baseline values explain more or no measure is reproducible.

Hypothesis 3 is that spatial mixture and sensation–temperature discordance add patient-important information beyond a global cold–heat score. If adding local variables to a prespecified baseline model fails to improve externally validated performance or decisions, complexity should be reduced. Hypothesis 4 is that the classical grammar of region, depth, and time enriches contemporary observation. If comprehension, repeatability, and discrimination do not improve, it remains historical interpretation rather than a clinical measure.

Hypothesis 5 is that response to Korean-medicine treatment may vary by event phenotype rather than by the direction of a thermal word. Current evidence cannot test this. Cases that cannot separate natural fluctuation, concurrent care, expectation, regression, and time may generate causal hypotheses but cannot establish effectiveness. Treatment response must not be used as a diagnostic test in the first study.

## The first study should begin with language, not devices

Stage 0 is a maximum-variation cognitive-interview study of approximately 15–20 adults experiencing recurrent heat on the back, hand chill, or burning palms or soles. Participants narrate a recent event and identify what is lost when the researcher summarizes it as “heat” or “cold.” They think aloud while interpreting items about body map, depth, boundary, movement, simultaneous sensations, triggers, relievers, and function. The purpose is not to teach traditional terminology, but to locate translation errors between patient language and research variables.

Stage 1 is a 14-day event-based longitudinal study. Fixed morning and evening diaries alone would miss brief events, so minimal scheduled entries are combined with records at onset, peak, and recovery. Body maps and P, C, and F take priority; ambient temperature, humidity, and wrist or finger skin temperature are synchronized where feasible. Primary outcomes are missingness, burden, event capture, overlap of maps for recurring event types, and within-person variability—not disease-classification accuracy.

Stage 2 is a standardized rest–provocation–recovery visit. Acclimatization, caffeine, smoking, exercise, meals, medication, menstrual timing, sensor placement, and emissivity are prespecified. Skin temperature, photographs, colour change, rewarming curves, and symptom concordance are collected from all participants; QST, perfusion, and autonomic tests are reserved for explicit subquestions. Assessors are masked to selected symptom narratives and prior results. Rather than one healthy-control group, mechanistically different comparators—such as Raynaud phenomenon, post-injury cold intolerance, and menopausal hot flushes—test whether the model improperly collapses distinct states.

Only Stage 3 asks about clinical added value. A baseline model using diagnosis, routine history, and global cold–heat score is compared with a prespecified model adding the local thermal field. External data must show better prediction of functional worsening, need for reassessment, patient-prioritized goals, or improved clinician decisions. Without added value, the field remains an interesting description and is not adopted as a clinical tool.

## What this synthesis cannot yet establish

First, this is a purposive critical synthesis of evidence families needed to work on the problem, not an exhaustive systematic review. Searches were limited to public routes available on 13 August 2026; full citation-network chasing, comprehensive Chinese-database searching, and duplicate independent screening were not completed. The search and passage ledgers distinguish sources inspected in public full text or primary-text pages from those inspected only at bibliographic-abstract level. In particular, the 2026 Korean–Japanese scoping review and several clinical or physiological sources support abstract-level claims only.

Second, counterexamples from different disorders and experiments establish a logical boundary—that “heat” and “cold” do not identify one mechanism—but do not establish the direct mechanism of back heat or hand chill. The public Donguibogam edition displays an observational grammar, but edition comparison and the Yixue Rumen source lineage remain incomplete, and there is no evidence yet that classical distinctions of region, depth, and time improve contemporary measurement.

Third, the local thermal field is an unvalidated author-constructed model. No patient data have tested its repeatability, incremental value, or harms, and no independent external assessment has been completed. It therefore does not justify diagnosis, prognosis, treatment selection, or claims of Korean-medicine treatment effectiveness. If language is unstable in cognitive interviews and event sampling, or if added information beyond global scores fails to replicate, the model should be reduced or abandoned.

## Research curiosity and clinical safety proceed together

Detailed study of localized thermal sensation must not delay ordinary differential diagnosis. New unilateral sensory loss or weakness, severe pain with swelling or colour change, skin injury, systemic fever, chest pain, dyspnoea, syncope, or rapidly progressive symptoms require care and reassessment before research classification. Recurrent white–blue–red colour change, persistent erythema and warmth, nocturnal burning, temporal links to medication or chemotherapy, and thyroid, haematologic, autoimmune, or metabolic signs open separate pathways.

At the same time, an unrevealing test must not erase the experience. If discomfort changes sleep, hand use, clothing, concentration, or willingness to leave home, it is a patient-important outcome. Safety must run two paths in parallel: do not miss dangerous disease, and do not abandon distress that remains unexplained. This is how BRC research connects with Baekrokdam clinical guidance: clinic pages support differential and care decisions, while this article supplies citable research questions, evidence, and limits.

## The next unit of cold–heat research

A person with back heat and hand chill does not need a more persuasive single label. The needed unit preserves what was felt where, how temperature and flow changed, when discordance recurred, and what it altered in life. Classical texts preserve a vocabulary of distribution, depth, and time; contemporary physiology shows multiple routes by which sensation and temperature can separate. Neither explains the patient alone. Better questions arise when the two are placed in rigorous, non-equivalent relation.

The claim remains modest: do not end cold–heat with one score; open it into spatiotemporal data. That small shift has large consequences. It makes it possible to ask, in one design, what treatment changed, whether experience or instrument moved first, and whether Korean-medicine observation truly adds information beyond standard history.

## Declarations

| | |
|---|---|
| **Author contributions (CRediT)** | Yeonseung Choe: Conceptualization, Methodology, Clinical framing, Research-system design, Writing – review & editing · Baekrokdam Research Commons (BRC): Investigation, Data curation, Writing – original draft |
| **Data availability** | No patient data were used. The form decision, question map, search and selection ledger, and claim–evidence ledger are published as machine-readable JSON. Copyrighted full text is not redistributed; public locators and the extent of verification are recorded. |
| **Funding** | No external funding. |
| **Competing interests** | BRC originated at Baekrokdam Korean Medicine Clinic, and author Yeonseung Choe is involved in its clinical and research design. Links to clinical guides permit navigation between care information and research evidence; they are not evidence of treatment effectiveness. Future effectiveness studies require protocol registration, independent statistical review, and conflict management. |
| **AI use disclosure** | AI tools assisted query expansion, candidate classification, counter-hypothesis generation, structuring, and translation drafting. Candidates not verified in public full text or a bibliographic abstract were not used for central claims. Yeonseung Choe designed the problem, form, and clinical direction; authors and editors remain responsible for citation existence, content, fitness, and final judgment. AI is not an author. |
| **Ethics** | This critical synthesis uses public literature and contains no human-participant data. Cognitive interviews, 14-day observation, sensor measurements, provocation, and treatment observation will not begin before a separate protocol and ethics review. |

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